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STOCK LICKS AND THEIR COMPOSITION.

SOME RECENT DEVELOPMENTS.

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IN feeding minerals to stock for the purpose of supplementing deficiencies in the natural pasture, one may be largely guided by the experience of other investigators in countries where the deficiencies are greater in degree than are found in New Zealand, and consequently where the matter has received more attention.

The Union of South Africa is perhaps foremost in the amount of careful work which has been done in experimenting on a large scale with cattle on poor country to determine the best methods of feeding minerals to the animal direct. In South Africa, it should be remarked, there is not the alternative of top-dressing the pasture with phosphates, for in that country this universal practice in New Zealand is not practicable in most deficient areas.

PHOSPHATE DEFICIENCY.

Sir Arnold Theiler and his co-workers, in exhaustive experiments to determine the cause and cure of certain puzzling troubles of stock which were gravely hindering pastoral development in the Union, had found that phosphoric acid deficiency was the main cause of a disease called "lamsiekte" (lame sickness), and pronounced so decidedly in favour of bone-meal as the form superior to all other phosphates for the cure, that one was left in no doubt as to the right phosphate to use. Bonedust was therefore adopted by the New Zealand Department as the phosphate recommended for making licks. Since then, however, Sir Arnold Theiler's collaborators (now his successors in these investigations) have looked into the matter from an economic point of view and have decided that when the artificial di-calcic phosphate (precipitated phosphate) was compared on a monetary basis with bone-meal in the relative effectiveness (1) in preventing pica (craving for unnatural food such as decaying carcasses, &c.), (2) in stimulating the growth of cattle feeding on phosphate-deficient natural food, the effective dose of bone-meal is at least twice as costly as the effective

dose of precipitated calcium phosphate. (See Du Toit and Green, 16th Report, Department of Agriculture, Union of South Africa, August, 1930, p. 267.)

The bone-meal in these experiments cost £8 per ton and the phosphate £12 10s. In New Zealand the price of bone-flour suitable for stock-feeding would be dearer than £8, while an equivalent substance supplying di-calcic phosphate would be cheaper than £12 10s. Hence the above discrepancy in the relative value of bone and precipitated phosphate would be magnified, and the cost of the latter would be cheaper in New Zealand than it would be in South Africa. Precipitated or reverted phosphate is made from superphosphate by merely dissolving it in water, filtering off the gypsum, precipitating the soluble phosphoric acid in the filtrate by the addition of lime, and separating the insoluble di-calcic phosphate from the liquid. In practice it does not seem necessary to follow all this procedure, when merely mixing the superphosphate with 15 per cent. of slaked lime will revert all the phosphate.

Another method of giving phosphate to cattle is by dissolving ordinary superphosphate in the drinking water. A trial at the Mamaku Demonstration Farm, which lasted over a year, with two cattle-beasts showed that this was a perfectly safe way of giving phosphate to stock on inferior pasture which had never been top-dressed. Both animals increased in health, and in nine months one, a young steer, was fit for the butcher.

Bone Char.

An alternative to bone-meal is a substance known as bone charcoal or bone char, a by-product of sugar refineries, where it is used to decolour the raw sugar. After a time and repeated calcinations the animal charcoal loses its efficacy, and is then available as a phosphate fertilizer, the phosphate content then amounting to from 72 to 82 per cent., or from 20 to 30 per cent. higher than that amount found in edible bone-meals. The Canadian Dominion Chemist, in his report for the year ending 31st March, 1930, suggests that the presence of charcoal may be useful in the animal economy by regulating or perhaps in preventing intestinal disturbances. In England spent bone char is more or less a drug on the market, and it is suggested by a writer in *Chemistry and Industry*, 12th February, 1932, p. 141, that it should be used for stock-foods, thereby reducing the necessity for introducing meals or bone-products into Great Britain. In New Zealand the Auckland sugar refinery of the Colonial Sugar Co. produces a quantity of this material, which is available for making licks.

Sulphur.

An element in animal nutrition which has generally been neglected is sulphur, an essential mineral required in fairly large quantities by some animals, particularly sheep. There are difficulties in analysing pasture samples for total sulphur, and many old analyses are obviously too low in the sulphur figure owing to lack of precaution in preventing the volatilization of some of the sulphur when ashing the sample. Sulphur occurs in most soils largely as sulphates, a class of salts which are easily leached out of the soil. Examples of other essential elements also lost in the drainage water in large quantities are sodium and

chlorine. In lands subject to salt-laden gales rain may bring down quantities of these elements, which are abundant in sea water. Theory suggests that the drier inland and often mountainous areas might, from their more sheltered position, prove deficient in sulphur, and it is this type of country which is more generally utilized in sheep-farming. The matter is one warranting extensive investigation in view of the importance of sheep to the prosperity of this Dominion and the demand of sheep for sulphur. Low results in the sulphur content of pastures have been found in this Department's Chemical Laboratory in the case of some Marlborough and Central Otago pastures, indicating the need for including sulphur in the salt lick provided for sheep.

In the Annual Report of the South African Department of Agriculture for 1931 (p. 481) a most interesting experiment is recorded by D. J. Steyn, under the heading "The Effects of Sulphur on Merino Sheep." He concludes as follows: "Sulphur can be administered to Merino sheep at the rate of 5 grammes once, three times, or six times weekly, over prolonged periods, with striking beneficial effects on their weight and wool yield. Furthermore, it has been established that the above amounts of sulphur given throughout the course of a year have no detrimental effect on the quality of the wool, and do not cause an increase in the cystine content of the wool." He found, however, that an excess of sulphur did harm—for example, when 15 grammes of sulphur were given three times weekly sulphur-poisoning symptoms developed on the thirty-fifth day of the experiment.

From consideration of these facts, it appears possible that a small dosage of sulphur to sheep on inland situations might have very beneficial effects on both mutton and wool production at a comparatively small outlay, considering that the sulphur can be easily mixed with the salt which is, or should be, normally fed to sheep. The present market price of sulphur is about £18 per ton.

Iodine.

A great deal of propaganda regarding iodine has taken place during the last decade in an endeavour to increase the consumption of an article of which much larger quantities are available. Those interested in the matter may be referred to an interesting article on the Chilean nitrate production in the *Journal of the Society of Chemical Industry*.* The veteran Agricultural Chemist for Queensland, Mr. J. C. Bruennich, draws attention to the great variation of iodine in commercial licks sold in that State, where no deficiency in iodine has yet been established. He advises that from 8 oz. to 16 oz. of potassium iodide per ton of mixed lick seems to be quite ample. It is by no means easy to mix such a small amount as this with a ton of mixed lick, and Bruennich reports extraordinarily high results obtained on analysis in the iodine content of commercial licks—results hardly to be wondered at.

There are indications that in areas where goitres do not appear in stock, mineral iodine fed artificially by means of licks, &c., ensures a greater milk yield from cows, a decrease in temporary sterility, an

* Raw materials often contain up to one part of $NaIO_3$ (sodium iodate) in 100 parts, so that there was no reason why iodine should not be produced in large quantities, as it is easily recovered. (*Journal of Society of Chemical Industry, Vol. 36, 1917, p. 63.*)

increase in weight and wool production in sheep, as well as an improvement in the general health of the animal. None of these benefits has been definitely and scientifically established in New Zealand yet, under controlled conditions, although certain reliable cases have been reported where undoubtedly good results have been obtained.

In districts where there may be an actual deficiency of iodine in the pasture—judged by the low amount present and the occurrence of goitre in stock—beneficial results from a therapeutic use of iodine are undoubted. Cases of simple goitre in sheep have been cured and their recurrence prevented by a discriminate use of potassium iodide. The iodine content of thyroid glands of lambs born and bred on definite areas seems to give a fair indication as to the amount of iodine available in these areas. (See this *Journal* for November, 1930, page 302, and September, 1931, page 210.) Systematic advisory work on iodine feeding to stock could be based on such analytical data, but until this has been obtained, great care must be exercised in the use of iodine, as serious consequences may arise from overdosage. Large amounts of iodine fed to stock may actually do harm.

Areas in New Zealand where goitre in sheep, &c., is known to occur comprise the following: (1) Areas at foot and top of Lake Wanaka, where lambs suffer from enlarged thyroid glands; (2) various localities in Westland, and the Grey Valley and its tributaries, where lambs are similarly affected with goitre; (3) some back-country on papa formation in Poverty Bay where calves are occasionally born hairless, and where an iodine lick given to sheep greatly improves their health and development. In these areas, and no doubt in others which cannot yet be defined, possibly a higher dosage than 3 oz. of potassium iodide per ton to the lick used may be adopted; but for a general lick to include iodine 3 oz. is all that is at present warranted in normal districts.

WEIGHT OF SILAGE AT VARYING DEPTHS IN PIT.

CONSEQUENT on the test weighing of silage in a hillside silo at Stratford Demonstration Farm, Mr. J. M. Smith, Instructor in Agriculture, supplies the following data regarding the weight of a cubic foot of silage:—

Bottom	52 lb.	5 ft.	43 lb.
1 ft.	48 lb.	6 ft.	41 lb.
2 ft.	47 lb.	7 ft.	39 lb.
3 ft.	45 lb.	8 ft.	36 lb.
4 ft.	44 lb.	9 ft.	35 lb.

Average weight per cubic foot, 43 lb.

This confirms the opinion that there is a great difference between the weight of silage at the bottom of a pit (or stack) and at the top. Naturally the actual weight per cubic foot will be dependent upon several factors, the chief of which are the raw material used and the stage at which it is cut. The way the material is packed into the pit must also have some effect on the resultant weight. However, as far as grass ensilage cut at the right stage is concerned, the weight of 43 lb. per cubic foot should be a fair standard to use.

The size of the pit at Stratford Farm is diameter 20 ft. and depth 14 ft. This gives a capacity of 4,400 cubic ft., which, at the rate of 43 lb. per cubic foot, means that the pit can accommodate 84½ tons of silage.

NEW ZEALAND PASTURE SEEDS.

WHAT THE DOMINION HAS TO OFFER.

(Continued.)

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(1) CERTIFIED NEW ZEALAND PERENNIAL RYE-GRASS.

This is a true perennial type localized in certain high-production areas, some of which have been under grazing for upwards of sixty years. Fields of this type are accepted for certification as mother-seed, provided they are five years old or older, pass a field inspection when in flower, and prove true to type by plot trial or ultra-violet light test. Certified New Zealand permanent-pasture rye-grass is the product of these mother-seed areas once-grown in any good seed-producing district. The fields are inspected at time of flowering, and the type is verified by trial after harvest.

The type is dense-crowned, multitillered, erect rather than prostrate, with foliage dark-green in colour; high producing, moderately early maturing, and capable of a good payable seed-crop; rather less rapid in seedling growth than ordinary commercial false perennial types,* but faster than British indigenous rye-grass. The deep green colour and the more erect habit are distinguishing features early in establishment, compared with the greyish-green, often steely-grey colour, and more flexed leaf and prostrate divaricating stem of the false perennial types.

This early colour difference noted in our broadcast plots of the true perennial type, as compared with the false perennial type, has definitely proved to be associated with differences in persistency, seasonal production, and time of flowering. The deep green, erect-leaved, tufted, and multitillered true perennial type persists and produces well, even under frequent cutting, while the lighter greyish-green colour and divaricating habit of the false perennial types is associated with lack of tillering and inability to persist either under pasture or hay, and this irrespective of the soil-type on which comparative trials have been conducted. Even on high-fertility soils the false perennial types fail to hold, being replaced by volunteers such as Poa trivialis, Yorkshire fog, New Zealand white clover, &c.

In the leaf-shoots, seed-heads, and general seed-crop the types of rye-grass show some characteristic differences. In the seedling stages the true perennial is folded in the leaf-bud and the tiller is flat-stemmed. At a similar growth-stage the false perennial usually tends to roll or at least to be less perfectly folded in the bud, and the tiller just below

* The false perennial types may be regarded as degenerate perennial rye-grass types that have lost their perennial nature, either as a result of hybridization between Italian and perennial rye-grass, or as a result of faulty methods of seed-production where maiden or first-harvest seed has been sown and reaped again and again until there has resulted only free-seeding, quick-maturing, non-persistent types of plants left in the strain, the tardy and more shy-seeding true perennial plants having gradually been eliminated. These degenerate perennials cross-fertilized with Italian rye-grass, and the resultant hybrids further crossed among themselves, have in large measure led to the deplorable state of nearly all commercial perennial rye-grass on the world markets to-day.

FIG. 2. NEW ZEALAND CERTIFIED PERENNIAL RYE-GRASS ON HIGH-FERTILITY COUNTRY, PRODUCING A DENSE-BOTTOM, WEED-FREE PASTURE. (COMPARE WITH FIG. 3.)

FIG. 3. A FALSE PERENNIAL RYE-GRASS PASTURE ON THE SAME SOIL-TYPE AND OF SAME AGE AS IN FIG. 2.

The rye-grass here has largely gone out, and white clover, Scotch thistle, docks, and Poa trivialis have taken its place. New Zealand certified seed is a safeguard against this type.

junction of blade and sheath is more or less circular in cross-section. In the period just prior to panicle production both the true and the false perennial incline towards a rolling of the leaf in the advanced tillers. The true perennial seed-stalks stand stiffly erect, with but slight tendency to droop or arch in the seed-head itself. The false perennial seed-stalk is not so erect, but divergent, with a decided droop or arch of the seed-head. The true perennial is never awned ; the false perennials are never strongly awned, but in a percentage of cases short awns appear, especially near the apex of the panicle and in the apical and subapical florets of some of the lower spikelets. Many of these practically

FIG. 4. A FORTY-YEAR-OLD SWARD OF NEW ZEALAND CERTIFIED PERENNIAL RYE-GRASS RUNNING UP TO A SEED-CROP.

At a little later stage than this the crop is inspected for certification purposes.

awnless, false perennial lines have been handled by merchants in the best of faith and belief that they were handling and offering true perennial rye-grass seed.

New Zealand true perennial rye-grass is less susceptible to rust than false perennial types, irrespective of origin. Rust attack seems relative to vigour. Just so soon as a type fails to maintain high vigour, and stops growing as summer approaches, it immediately becomes susceptible to rust. The more vigorous true perennial strain resists the attack until late in the season, whereas the weaker-constitutioned false perennial types cease growth early in the season and immediately fall a prey to rust. No imported line of rye-grass has resisted rust so well as New Zealand true perennial.

All the imported English, Irish, and Scottish lines of commercial perennial rye-grass failed badly after two years' broadcast trial at the

Plant Research Station. Lines from Germany, Sweden, Russia, Denmark, America, and Australia ranged from bad types to good types of false perennial. Guaranteed British indigenous old pasture rye-grass from Kent has persisted better than any other imported strain.

Table 1.—Comparison of New Zealand Rye-grass Types with Imported Commercial Perennial.

Line.	Relative Recovery after One Year.	Relative Persistency after One Year.	Relative Degree of Rust Resistance.
N.Z. true perennial ..	100	100	100
N.Z. false perennial ..	40	50	36
Imported	49	55	35

From the above data the marked superiority of the New Zealand true perennial type (certified standard) over both New Zealand false perennial and imported lines is very clear. None of the New Zealand false perennial lines are accepted for certification.

(2) Certified New Zealand White Clover.

This is an outstanding type of white clover, extremely high producing, large-leaved, long-petioled, widely spreading, with stout stolons, dense, and persistent. It establishes rapidly from seed and asserts its superiority over every other type yet tested right from the offset. It is essentially the product of the environment of the perennial high-producing pasture where any species to persist at all must necessarily be high-producing and of long seasonal growth. Certified New Zealand white clover is a comparatively good winter-growing form, is early away in the spring, and holds well into the autumn. It is essentially a dairy-pasture type, but is in New Zealand also now asserting its superiority over all other types where sown for comparative purposes on quite low-fertility soils.

In New Zealand this type normally occupies the most favoured grassland areas in both Islands, where it may occur either as a pure stand or as an important member of the sward. Plots at the trial grounds at Palmerston North sown down to this type, after two years are pure white clover swards, whereas the ordinary types have either run completely to weeds, Poa annua, and brown-top, or are at least partly overrun. The Kentish wild white clover has held moderately well, and ordinary New Zealand not quite so well as the Kentish, while the imported lots have completely run to weeds, Poa annua, and brown-top. Table 2 shows the relative production of the various types of white clover over a two-year period, and illustrates the degree of superiority of the New Zealand types Nos. 1 and 2 over all other types. New Zealand certified white clover now offering is dominantly No. 1 or No. 2, or mixtures of these two types. Up to the present New Zealand white clover has been in good demand in Great Britain, and some outstanding successes have been secured. It is more than probable that the type now being offered as certified New Zealand white clover is entirely responsible for the successes with New Zealand white clover that have been met with in the past in Great Britain. The ordinary New Zealand white clover emphatically is better than the Dutch white clover type that Great Britain uses so extensively.

It is confidently expected that the New Zealand certified type now being offered will more than hold its own with any other white clover type from any country in the world. Roughly speaking, 10 per cent. of the white clover crops produced in New Zealand are dominantly of the type now being certified. Areas producing this type are being located, and after further testing in trial plots are declared mother-seed areas. Certified New Zealand white clover—permanent-pasture standard—is derived from crops produced as a result of sowing down with certified mother-seed, or are drawn from those areas not quite pure enough to be classed as mother-seed. The mother-seed areas on the whole are old pastures, and the seed for the most part is dressed out of New Zealand true perennial rye-grass seed crops.

Hitherto, New Zealand certified crops of white clover have been based on age, and have been sold under the name "certified New Zealand old pasture." These lines on being plot-tested for type have not all come up to standard, and hence certification on age alone has been abandoned and certification on type substituted. The term "New Zealand wild white" has been used extensively in the trade and in writings of New Zealand workers. Owing to the marked superiority of the New Zealand certified strain as now recognized, and in view of New Zealand working definitely towards improved strains, it has now been decided to drop the term "wild" in connection with our certified white clover, leaving that term, because of priority, to the Kentish white clover type.

Table 2.—Relative Production of Contrasting Types of White Clover during Two Years of Trial. (Plots sown November, 1929.)

Analysis of 631 lines. New Zealand Wild White Type No. 1 = 100 at each period.

Type.	Number of Lines averaged.	Percentage of Lots of each Type in N.Z. Commercial White.	Relative Production at Dates specified.						
			4/2/30	30/7/30	16/10/30	4/12/30	23/1/31	10/3/31	29/6/31
N.Z. White No. 1 ..	37	6·3	100	100	100	100	100	100	100
N.Z. White No. 2 ..	20	3·4	95	92	89	81	81	74	60
Ordinary N.Z., plus trace N.Z. White Nos. 1 and 2	179	30·4	97	80	81	82	76	70	42
Ordinary N.Z., free of N.Z. White Nos. 1 and 2	344	58·4	87	51	64	55	45	35	13
N.Z. "Dutch" types	9	1·5	87	27	36	28	27	14	0·86
Kentish	15	..	68	55	74	63	60	50	50
Dutch imported ..	25	..	98	37	45	24	18	7·3	0·6
Ladino imported ..	2	..	100	75	68	30	51	50	Nil

(3) Ordinary New Zealand White Clover.

A good deal of this type will find its way on to the market outside certification. It is worth buying whenever the certified New Zealand white clover cannot be secured. Apart from a very few exceptions—less than 2 per cent. of the entire crop—ordinary New Zealand white clover is far superior to the imported Dutch types that dominate the commercial markets of Great Britain, the Continent of Europe, and America. These Dutch types, even under the mild climate of New

FIG. 5. NEW ZEALAND CERTIFIED WHITE CLOVER (ON THE RIGHT) COMPARED WITH KENTISH WILD WHITE CLOVER (LEFT) AT PLANT RESEARCH STATION TRIAL-GROUNDS.

In these trials the New Zealand certified type in every record scored considerably higher in production than the Kentish wild white (see Table 2).

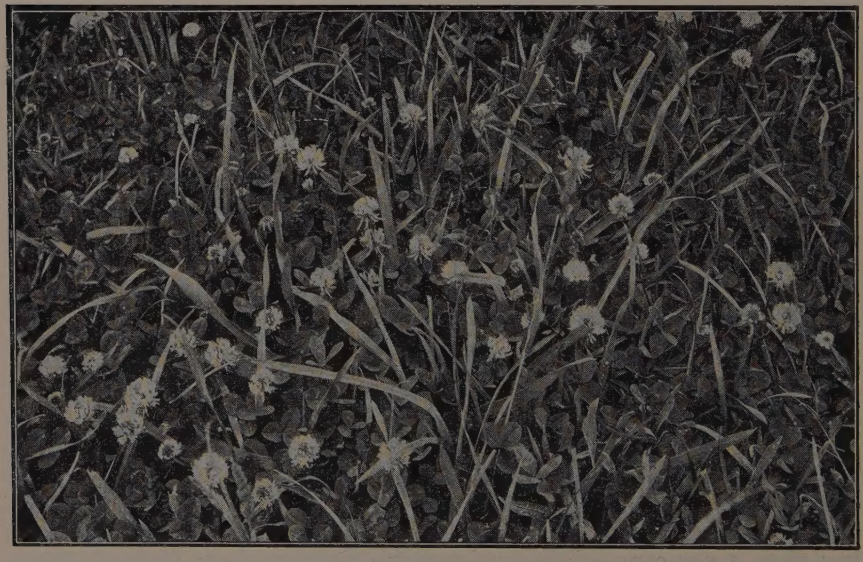

FIG. 6. ORDINARY NEW ZEALAND WHITE CLOVER IN A PERMANENT PASTURE WHERE THE CLOVER CONTENT HAS BEEN KEPT UP BY PHOSPHATIC MANURING.

Ordinary New Zealand white clover does well in the field, but there is not the sustained growth as with the New Zealand certified type. Ordinary New Zealand white clover is far superior to any of the European commercial white clovers.

Zealand, are little better than annuals. Lines of ordinary New Zealand white clover may frequently contain a small percentage of good New Zealand No. 1 and No. 2 types, and when these lots are sown the presence of even quite a small percentage of the good New Zealand types in the line ultimately leads to dominance of this type under good management conditions. Plots at the Research Station area that two years ago contained just a trace of Types Nos. 1 and 2 now are becoming dominantly the No. 1 and No. 2 types, the inferior strains having gone out, leaving room for rapid spread of the few plants of the good types originally present in the line. Were it not for the fact that New Zealand is setting an exceedingly high standard for its certified seeds as far as type is concerned, virtually the whole of New Zealand white clover could be certified to as being superior to any commercial strain—excluding Kentish wild white—now on the market.

(4) Kentish Wild White.—New-Zealand-grown certified Kentish Wild White.

Seed of Kentish wild white is being produced in New Zealand on as yet a small scale. The mother-seed for the sowing-down of these areas is being secured from a reliable source in Great Britain, and plot trials are conducted in New Zealand prior to or collaterally with sowings made in the field. The resultant crops from these areas are certified to as New-Zealand-grown Kentish wild white type. These crops are being produced on maiden country, so as to avoid possible contamination with our ordinary New Zealand strains. Naturally some time must elapse before New Zealand can with confidence launch out extensively in the production of Kentish wild white clover. There is just the possibility that under normal New Zealand conditions the New-Zealand-bred strains, being higher-producing, will tend to take charge of the Kentish type and thus prevent pure swards being secured here. However, there is every possibility of the Kentish wild white type doing exceedingly well on soils in New Zealand that normally do not carry much natural white clover. This refers particularly to our brown-top belt, which occupies several millions of acres of the colder, stiffish wet clays. Certainly it would be useless sowing Kentish wild white for seed-production or for any other purpose on high-fertility dairying country where the good New Zealand types are already in existence. The Kentish type would probably never get established there owing to the intense competitions that so soon arise.

Kentish wild white as a type appears excellently suited for sheep-pasture rather than cattle-pasture, and for those soils somewhat below the fertility standard for high-producing types of white clover. In other words, if the habitat range of white clover is to be extended the Kentish wild white type is more likely to effect this than any other type yet met with in the white clover type studies that have been carried out in New Zealand. Though advocating the use of a low-production strain, I feel we should impress rather the desirability of making every effort to improve soil conditions to the point that high-producing strains may thrive, rather than accept low-production strains to fit the impoverished soil conditions as they exist at the moment. As before stated, however, because we have no low-producing permanent clover, but only low-producing annuals, strain work to evolve low-production types is justified in white clover probably more so than in any other herbage species.

(To be continued.)

GERMINATING CAPACITY OF PERENNIAL RYE-GRASS SEED.

NOTES ON INVESTIGATIONAL WORK IN PROGRESS.

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SAMPLES of most of the current season's crops of perennial rye-grass seed have now been submitted for germination test, and it is apparent that, while the seed harvested in Canterbury, Hawke's Bay, and Poverty Bay is of excellent quality, much of that from the Manawatu, Otago, and Southland districts, owing to its low germinating capacity, is much inferior. Those interested in the production of certified perennial rye-grass seed in the latter districts have been greatly disappointed, and many have made inquiries of the Seed Testing Station at Palmerston North for information concerning the nature of the trouble. In view of the renewed interest in this matter, it is thought advisable to review the investigations already made and to indicate what further steps are being taken towards the solution of the problem.

The problem is not a new one, for it has been observed for some years that there occur occasionally in some districts, and more frequently in others, seasons in which the value of many crops is seriously impaired by the low germinating capacity of the seed. The following table is based on the germination percentages of all samples received by the Seed Testing Station from the main rye-grass seed producing districts during the last eight years :—

Table 1.—Average Germinating Capacity of Perennial Rye-grass Seed.

Year.	Hawke's Bay.	Sandon.	Canterbury.	Southern.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1924	93	82	91	84
1925	91	67	87	88
1926	93	81	83	74
1927	83	74	80	74
1928	68	76	74	76
1929	76	82	80	85
1930	67	48	78	72
1931	93	87	89	71

The matter first became the subject of systematic inquiry in 1923, when the crop in the Sandon district was found to be very poor. In the following years records were kept of the weather conditions at the time of flowering, and during the period of the development and harvesting of the seed. By 1927 it was apparent that seed of poor quality is produced when humid conditions predominate during the period between flowering and the ripening of the seed. (See remarks by N. R. Foy in this *Journal* for March, 1927, pages 188 and 189.)

In 1929 an experiment was planned to determine the effect on the quality of the seed of the degree of maturity at harvesting. For this purpose an area of rye-grass pasture was enclosed on the experimental area of the Department of Agriculture at Marton. The season was very wet, and the crop became rank and lodged. At the completion of the

experiment it was found that the various methods of harvesting employed produced no significant differences in the quality of the seed, which, like almost all other rye-grass seed crops produced in the district in that season, was of very low germinating capacity. It was noted with interest that seed from a strip of pasture growing under drier conditions beneath the shelter of a spreading hedge of Cupressus macrocarpa was of greatly superior quality.

Another phase of the investigations was the study of such physical properties of the seed as water content and bushel weight. No significant correlations with high or low germinating capacity were observed.

More recently attention has been turned to the examination of the caryopses or "kernels." There were observed in samples of seed of low germinating ability many caryopses distinguishable from the normal type by the following peculiarities: (1) Their opacity; (2) the roughness and reddish colour of the surface; (3) the presence of fungal hyphæ and spores on the surface of the caryopsis; (4) the presence of fungal hyphæ penetrating the pericarp, the testa, and frequently also the endosperm.

From each of a large number of samples of seed of low germinating capacity one hundred seeds were taken, and the proportion of abnormal seeds of the above type determined. The two parts of each sample were then tested for germination. The results of a number of these tests are shown in the following table:—

Table 2.—Analysis of Lots of 100 Seeds of Perennial Rye-grass.

Abnormal Seed of Type described in Text.		Remainder.	
Number.	Number germinating.	Number.	Number germinating.
61	0	39	36
90	0	10	7
16	0	84	76
34	0	66	56
32	0	68	55
48	0	52	45
44	0	56	47
29	0	71	66
27	0	73	57
47	0	53	39
86	0	14	10
88	0	12	11
20	0	80	80
23	0	77	70
51	0	49	38
26	0	74	69
78	0	22	19
61	0	39	22
16	0	84	75
70	0	30	26
32	0	68	54
40	0	60	51
55	0	45	42

It thus became apparent that none of these abnormal seeds were capable of germination, and also that in almost every sample the abnormal seeds of this type accounted for the greater part of the dead

FIG. 1. CARYOPSES (KERNELS) OF PERENNIAL RYE-GRASS: UPPER ROW DISEASED (NOTE THE ROUGH SURFACE AND SHRUNKEN EMBRYOS), LOWER ROW NORMAL. ENLARGED.

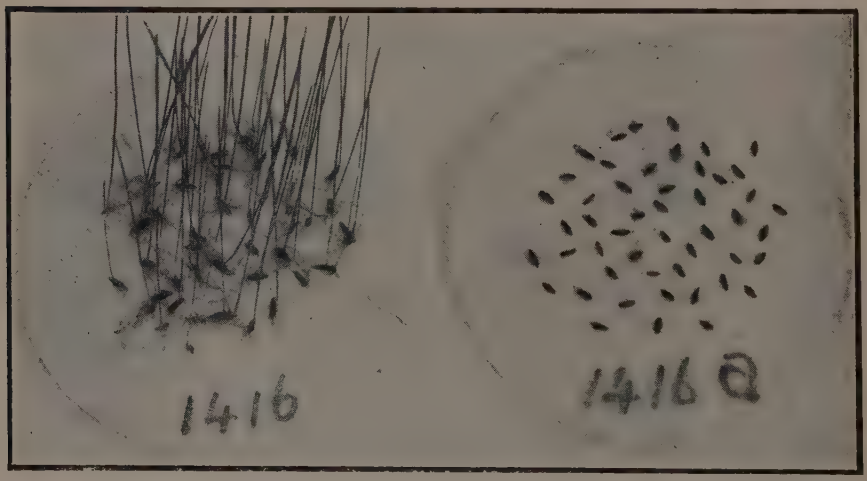


FIG. 2. PERENNIAL RYE-GRASS SEED, NORMAL (LEFT) AND DISEASED (RIGHT), PHOTOGRAPHED AFTER EIGHT DAYS UNDER CONDITIONS FAVOURABLE TO GERMINATION.

seed. Many samples of low germinating capacity and representative of the harvests of 1930, 1931, and 1932 have been examined. The foregoing examples are typical of the general conditions.

Samples of the diseased seeds have been submitted to the Plant Research Station Mycologist, Dr. G. H. Cunningham, who reports that a fungus which he is now preparing to identify has been isolated from surface-sterilized seed. Whether the fungus is parasitic and the primary cause of the death of the caryopsis, or whether it is saprophytic, only penetrating the caryopsis when this is already killed by some physiological disease, is not yet definitely known. In the present state of our knowledge it appears probable that the disease is caused by a fungal parasite, but assurance on this point depends on the results of further work being undertaken by the Mycologist.

The examination of a large number of samples has shown that perennial rye-grass in all districts is subject to the disease, and that even in an exceptionally good season the crops may not be entirely free.

Evidence is accumulating to indicate that the superior strains of perennial rye-grass are more susceptible to the disease than are inferior strains. It has been observed in several instances in different parts of Otago and Southland that while seed of comparatively high germinating capacity was harvested from fields of the local inferior strains of rye-grass, the crop from an adjacent field of certified perennial rye-grass was of very poor quality owing to the high percentage of diseased seeds. It is worthy of note in this connection that the average germinating capacity of samples of certified perennial rye-grass seed from Southland and Otago in 1930 was 27 per cent., whereas the average germinating capacity of samples of uncertified perennial rye-grass seed from the same districts in that year was 74 per cent. Similar experience in the Sandon and Rangitikei districts where both Hawke's Bay and Southern strains of rye-grass have been sown also leads to the belief that the former strains are more susceptible to the disease.

The possibility of producing superior strains of perennial rye-grass which are less susceptible to the disease is being investigated by the Agrostologist, Mr. E. Bruce Levy.

Work is being continued along the lines indicated, and knowledge of the nature of the disease should soon be greatly extended. For the present one can only endorse Mr. Foy's conclusion that for the production of perennial rye-grass seed of good quality dry conditions during the period of development of the seed are essential. Those districts with a dry summer climate must be looked to for the production of perennial rye-grass seed of reliable quality. On the other hand, it would appear to be unwise to advocate the extensive production of certified perennial rye-grass seed in those parts of the Southland, Otago, and Manawatu districts where the summer climate is generally more humid.

It is also suggested that in districts where the weather has been unfavourable during the period of development of the seed growers would be well advised to submit to the Seed Testing Station for examination samples of seed taken shortly before the time of cutting. In this way the expenses of harvesting and dressing almost worthless crops might be avoided.

FLEECE-TESTING FOR MEDULLATED FIBRES.

THE GRADING OF ROMNEY FLEECES.

B. L. ELPHICK, B.Sc., Massey Agricultural College, Palmerston North.

IN an article in the March issue of this *Journal* the writer gave an account of the recent investigation into the mode of distribution of medullated fibre over the Romney fleece. It was found that this mode of distribution can be described by a very simple rule, so that the problem of fleece-sampling is thereby very much simplified. Following up this work the writer is engaged in developing on scientific lines a simple system by which it will be possible to grade Romney fleeces for breeding purposes according to their content of medullated fibres.

It is common knowledge that in recent years there has been an outcry by the English wool-manufacturing trade against an imputed deterioration in our Romney wool clip, especially with regard to the presence of hairy or strongly medullated fibres. It may be comforting to reflect that perhaps this outcry is more vehement than the actual facts warrant, but nevertheless it cannot be denied that there is very considerable room for improvement in the average standard of this wool.

The soundest way of bringing about an improvement in the quality of any breed of animals is to adopt some system whereby important inherited characteristics of individuals may be described, classified, and so recorded. For only by making it possible to *record* these characteristics in the case of individual animals can their pedigree be properly based on quality of production. Thus, to take an example, in the dairy industry the system of herd-testing, by actually measuring and recording the production of individual cows, enables the breeding of dairy cattle to be directed more accurately along profitable lines than would be possible by any less scientific means. So also in the wool-growing industry the ability to evaluate and record the inherited characteristics of the fleeces of individual stud sheep, also of flock rams, would be of inestimable value to the industry in its efforts to bring about a general improvement in our crossbred wool clip, and so retrieve and enhance its reputation on the world's markets.

Although the production of medullated fibre by a Romney sheep is undoubtedly affected by the feeding and climatic conditions in which the animal is kept, just as the output of butterfat of a dairy cow is also affected, there appears to be no escape from the conclusion that, like high-production capacity in the dairy cow, the disposition to produce medullated fibre is fundamentally controlled by inheritance. One may find badly hairy and good-woolled flocks running side by side on the same country and feed, while the same differences are even more common between the individuals of a single flock. These differences can only be differences in the hereditary make-up of the sheep themselves, and the wool research workers at Massey Agricultural College are becoming more and more convinced that the much-needed reduction in the amount of hairiness in our Romney wool clip is chiefly a matter of more careful selection and breeding. Hence any means of grading the fleeces of Romney rams and breeding-ewes, particularly in the stud flocks, according to their content of medullated fibre is bound to be of value.

It is obviously very important to know as precisely as possible in what way different types of climate, country, and feed affect the production of medullated fibre by those animals that have inherited a distinct tendency towards this defect. Several observations and small-scale experiments have already been made in this connection, but insufficient data have yet accumulated to warrant any statement of results and conclusions. A commencement, however, of fleece-testing experiments on a large scale was made during the past spring on 160 animals from three different flocks. It is hoped that it will be possible to continue examining these and other animals and their progeny for a number of years in order that a careful study may be made of the following points :—

(1) Development and simplification of the technique of flock-testing.

(2) Accumulation of further data on the mode of distribution of medullated fibre over the Romney fleece. This is needed to confirm the very encouraging results already obtained from the study of a small number of animals.

(3) The relation between the first, second, and third, &c., fleeces of Romney sheep in regard to medullation.

(4) Inheritance of the disposition to produce medullated fibre. Large-scale breeding experiments in which the fleeces of parents and progeny are graded according to their content of medullated fibre will throw much light on the manner in which the tendency to produce medullated fibre may be inherited and passed on to succeeding generations.

(5) Influence of climate, country, and feed. By testing the successive fleeces of small numbers of sheep that are transferred from one type of country or feed to another, the various effects of climate, country, and feed on the production of medullated fibre will, it is anticipated, be definitely ascertained.

(6) By studying the constitution of the sheep in relation to the nature of their fleeces, it is hoped to throw much light on the vexed question of whether or not it is possible to maintain a vigorous constitution and completely eliminate medullated fibre from the fleece at the same time.

The study of all these important and ever recurrent questions is made possible by the development of a means of grading fleeces according to their degrees of medullation, so that in this respect the individual fleece quality of large number of animals may be accurately ascertained and recorded.

The following notes indicate the developments that have been made in the technique of fleece-testing. A card-index system of filing the records of all fleeces tested is being put into operation. This will form the nucleus of a system whereby the pedigree of rams and valuable breeding-ewes may be more accurately based on quality of wool production than has been possible in the past.

The Technique of Fleece-testing.

It is obvious that if the grading of fleeces is to be of practical value it must be possible to carry out the necessary fleece examination in the minimum amount of time, and careful attention has consequently been given to the development of a suitable technique for sampling. The problems faced in this connection are twofold. Firstly, there is the question of the number and position of the staples to be selected as a fleece sample; secondly, there is the evolution of the method by which these samples may be selected, labelled, and packed most expeditiously.

Dealing first of all with the selection of the samples for test, the reader is referred to the previous article in the March issue of the *Journal*, wherein it is shown that according to all present available data medullation disposes itself over the Romney fleece according to a simple rule. Based on this rule provisional recommendations were made as a guide to breeders in the testing of their own rams and ewes by means of the benzol test.

It must now be pointed out that the number of staples required as a sample of a fleece depends on the purpose for which the fleece-testing is being carried out. For the purpose of the large-scale experiments outlined above, where comparatively small numbers of fleeces, subject to a variety of carefully observed feeding and climatic influences, have to be compared, as accurate an evaluation as possible of each fleece is required, in order that the results can be dealt with mathematically, and the relative importance of the various influences ascertained. In such cases the data so far obtained have shown that the three fleece areas—shoulder, side, and britch—(as defined on page 195 of the March *Journal*) on one side of the animal must be sampled, and a sufficient number of staples taken from each area to provide a properly representative sample.

An investigation has been carried out with a view to finding the number of staples that are necessary for this purpose. Each fleece area of each of the three two-tooth ewe fleeces was repeatedly sampled, sometimes three times, sometimes four times, taking either six or twelve staples per sample. These samples were tested by the benzol test, and the degree of medullation of each staple evaluated out of a maximum of 300. The results are summarized in the accompanying table.

Studied mathematically, these figures show that for the six staple samples the mean coefficient of variation is 20·1 per cent., while for the twelve staple samples it is 11·1 per cent. Translated into non-technical language, this means that the error involved in relying on six staple samples is nearly twice as much as when twelve staples per sample are taken, and that, on the average, samples of six staples per fleece area are liable to be inaccurate to the extent of either 20 per cent. too high or too low. However, considering the very great range in degrees of medullation encountered, the writer is inclined to the opinion that *for experimental purposes*, when more than a few sheep are being dealt with, samples of six staples per fleece area (*i.e.*, eighteen staples per fleece) will in most cases be sufficient. We may for convenience speak of this mode of sampling as "experimental sampling," in order to distinguish it from the less detailed sampling which would be carried out by a breeder in examining his own sheep.

Fleece Grading for Breeding Purposes.

Turning now to the systematic grading of fleeces for breeding purposes, judging from the results of the fleece examinations already made, it appears highly probable that it will be possible to grade fleeces simply according to the extent to which the medullation has spread forward along the side of the animal. In this case the selection of samples would be very much simplified. The question as to whether or not this is a sufficiently reliable method of judging the degree of medullation of a fleece will, it is anticipated, be decided as one of the results of the large-scale fleece-testing investigation now in hand.

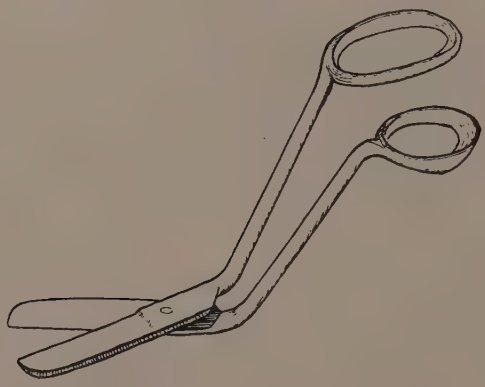
Results of repeated Sampling of Three Romney Two-tooth Ewe Fleeces.

Fleece Areas	Right Shoulder.	Left Shoulder.	Right Side.	Left Side.	Right Britch.	Left Britch.	Neck.	Back.	Rump.
				Fleece 1.					
Number of staples per sample	6	6	6	6	6	6	6	6	6
Average test of each sample	0·8 0·3 0·2	1·3 0·3	34 30 15	20 26 41 32	59 86 73 57	75 95 80 82	0 0 0 0	1 Tr.* 1 Tr.*	17 33 23 33
Average of all samples	0·4	0·8	26	30	69	83	0	0·5	26
				Fleece 2.					
Number of staples per sample	12	12	12	12	12	12	12	12	12
Average test of each sample	15 14 18	15 5 10	56 46 52	52 49 49	101 100 102	89 80 72	0 0·3 0·3	10 11 12	43 43 49
Average of all samples	15·7	10·0	51·3	50·0	101·0	80·3	0·2	11·0	45·0
				Fleece 3.					
Number of staples per sample	12	6	12	6	12	6	12	12	12
Average test of each sample	56 57 57	61 38 59	89 83 122	105 113 107	101 101 105	89 78 102	25 29 25	70 75 66	78 73 63
Average of all samples	56·7	52·7	98·1	108·3	102·3	89·7	26·3	70·3	71·3

* Tr. = trace of medulla.

NOTE.—Each fleece area was repeatedly sampled either three or four times, a sample comprising sometimes six, sometimes twelve staples. The degree of medullation of each staple was evaluated with the aid of the benzol test out of a maximum of 300 (*i.e.*, 0 = all pure wool, 300 = all hair). The "Average test of each sample" represents the average of the values thus assigned to each of the six or twelve staples comprising the sample; while the "Average of all samples" represents as nearly as is known the true average value for each fleece area. It is considered, taking into account the wide range of values encountered, that the six staple samples agree sufficiently well among themselves for the purpose of large-scale "experimental sampling" of fleeces.

In selecting staples for test, if the proportion of medullated fibre in the staple is required, it is important that the whole of the staple should be obtained. Therefore the staples should not be pulled out, but cut off as near the skin as possible. When large numbers of samples have to be taken, ordinary scissors are not convenient for this purpose, and a special pair of scissors with the blades and handles bent at about sixty degrees to the shafts has been found very convenient for the purpose.



SPECIAL SCISSORS USED FOR FLEECE-SAMPLING.

When, as in the case of "experimental sampling," very large numbers of staples have to be taken at one time, it is often inconvenient and always wasteful of time to test them as they are cut. A simple method has therefore been developed whereby the staples may each be labelled and packed for transport or storage with great rapidity. The staples, as they are cut, are placed between the leaves of a small "sample book," made of stapling together a suitable number of sheets of paper 8 in. by 5 in. Each leaf is marked with the number or position of the staple, and when filled the book is rolled up, tied with string, and labelled with particulars of the animal and fleece area from which the staples are taken. Samples are thus rapidly and conveniently secured for transport and storage.

By adopting these developments in technique staples can be selected from definite positions in the fleece, cut, and each labelled and packed separately, by two workers at the rate of four to five staples per minute, taking into account also the time spent in handling the sheep. Thus, for example, 900 staples were recently selected for experimental purposes from the fleeces of fifty hoggets in the space of three hours twenty minutes. Thus it will be seen that it is rapidly becoming possible and practicable to grade the fleeces of the more valuable Romney rams and ewes scientifically, according to their content of medullated fibres.

In conclusion, the writer wishes to emphasize what he considers to be the outstanding value to the wool-growing industry of this new means of grading individual fleeces according to one of their most important qualities—namely, that it enables that quality to be *recorded*, so that the pedigree of breeding-stock can be more accurately based on quality of production.

PASTURE TOP-DRESSING TRIALS IN OTAGO.

SUMMARY OF RESULTS FOR SEASONS 1927, 1928, AND 1929.

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IN 1927 a number of top-dressing trials were laid down on pastures in various parts of Otago, with the object of endeavouring to ascertain the effect of top-dressing in the production of hay. An effort was also made to determine the lasting effect of certain fertilizers by carrying out observations and weighings over a period of three years from the time of the original and only top-dressing given to the plots. Two years' results in regard to these trials have already been published in the *Journal*, and it is not intended in this summary to treat extensively individual experiments, as it is felt that a review on broad lines regarding the effect of the various fertilizers under trial will prove of greater general application than the publication of a mass of detail on individual results. This summary, therefore, covers thirty-eight experiments.

PLAN OF THE EXPERIMENTS.

Various types of pastures throughout Otago were selected for top-dressing trials. In arranging the scope of the experiment a uniform plan was adhered to throughout, the drill-strip method of replicated plots being employed in applying the fertilizers, thus allowing all results to be statistically examined. The objects of the experiments were comparatively simple, being to test the efficiency of phosphates both alone and in conjunction with carbonate of lime, and, further, to acquire definite information as to the value of applications of lime alone on pasture.

The phosphates under trial were superphosphate, 44–46 per cent. tricalcic phosphate, equal to a minimum of 20·2 per cent. phosphoric acid (44–46 per cent. grade), and basic slag (Trifolium brand, 17–20 per cent. phosphoric acid grade). These manures were applied at the rate of 3 cwt. per acre (with three exceptions), and cross-dressings of carbonate of lime in a finely ground condition were applied at the rate of 1 ton per acre. The plots were dressed during the months of July, August, and September, 1927. At an appropriate season they were shut for hay, and hay weights were eventually taken.

On account of the large number of plots to be examined, it was practically impossible to harvest each at its peak of production; consequently, it will be noticed that those experiments carried out on high-class land sometimes show comparatively low weighings when compared with those on poorer soil-types. Again, seasonal differences in the various localities wherein the plots are situated account for variations in total production. The yields, therefore, given throughout in no way represent the relative fertility of the different plots.

PASTURE TYPES.

As the experiments progressed, it became increasingly apparent that the main factor in the effectiveness of a fertilizer was the pasture type, with its various associations of grasses and clovers. The presence

of a good amount of red clover, for instance, invariably resulted in increased general growth when the plot was dressed with phosphates, resulting in that experiment giving large increases over the unmanured or control plots, whereas pastures practically devoid of clover gave little response to dressings of phosphate. Quick-growing rye-grass, white clover, and red clover associations invariably responded more vigorously to top-dressing than less productive and slower-growing pasture types.

For the purpose of this summary it has been found advisable, therefore, to classify the types of pasture upon which the experiments have been carried out into four main groups designated types A, B, C, and D. Although no hard-and-fast definition can be laid down for each type, owing to the mergence of characteristics, the following arbitrary description in the main covers the classification of the various pastures under experiment :—

Type A : Young grass, vigorous growing, predominantly constituted of rye-grass, red clover, and white clover. Sole close, but not sod-bound. High-production pasture.

Type B : Dominantly rye-grass and white clover, with practically no red or alsike clover. Admixed with cocksfoot, dogstail, and other grasses. Sown down for a considerable time. Not so vigorous as type A. Dense sole, good producing pasture.

Type C : Dominantly cocksfoot, dogstail, and grasses other than rye-grass, which latter is present only in negligible quantities. Practically no white clover. Usually strong suckling clover. Close sole. Moderate production, inferior to types A and B.

Type D : Dominantly brown-top (*Agrostis tenuis*), with minimum of clover growth and practically no rye-grass. Dense matted sole, often admixed with dogstail and sweet vernal. Low production and inferior to types A, B, and C.

In regard to these pasture types, it can be conceded that the type is a direct indicator of the fertility of the soil upon which it is growing. Thus type A pastures represent soils of high fertility, and type D soils of low fertility.

Measurement of Results.

It is fully realized that the effects of various fertilizers on pastures are manifold, such factors as palatability, swarding, and changes in plant associations being intimately bound up with increased production where such takes place. These effects, however, are difficult to determine and record, although in many cases they are quite noticeable. The main factor of increased production, however, does lend itself to the measurement, and even although this factor is difficult to estimate in its entirety, it can be taken as a fairly reliable comparative index of the effect of the various top-dressing materials used in an experiment. Therefore the gauge utilized in estimating the effect of the various fertilizers in this series of experiments was the hay weight produced on the treated plots as compared with the hay produced on the control or unmanured plots. No consideration is here taken as to the effects of early production and the aftermath, so that it must be realized that the production figures given in no way represent the total production or represent the complete effects obtained by the application of the various manures.

Experiments on Type A Pastures.

Six trials on type A pastures were carried out, and of these five were shut up for hay and harvested for three years in succession. In

the case of the trial on the property of Mr. R. G. Borrie, of Papakaio, this was only harvested during two successive seasons. Details of each year's yield and the total yield over the seasons during which the trials were harvested are given in the following table :—

Table 1.—Results of Hay Manurial Trials on Type A Pastures.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
First Year.						
D. Smollett, Awamangu	1·70	1·75	2·56	1·80	1·82	2·61
R. G. Borrie, Papakaio	0·62	1·30	0·72	0·77	1·51	0·80
R. Kinnard, Maungatua	1·76	2·38	2·26	2·03	2·52	2·26
Mrs. Manson, Enfield ..	0·75	1·61	0·85	0·76	1·52	0·86
A. Tweed, Moneymore	1·15	1·48	1·47	1·23	1·52	1·47
J. Williamson, Bortons	0·37	2·20	0·51	0·48	2·17	0·60
Second Year.						
D. Smollett, Awamangu	2·80	3·01	3·52	3·23	3·11	3·61
R. G. Borrie, Papakaio	0·50	0·55	0·50	0·52	0·55	0·52
R. Kinnard, Maungatua	2·95	3·40	3·20	3·20	3·70	3·60
Mrs. Manson, Enfield ..	1·15	1·30	1·22	1·15	1·32	1·20
A. Tweed, Moneymore ..	1·72	1·85	1·72	1·70	1·85	1·72
J. Williamson, Bortons	0·20	0·32	0·22	0·15	0·30	0·20
Third Year.						
D. Smollett, Awamangu	1·80	1·85	2·10	2·00	2·05	2·25
R. G. Borrie, Papakaio*	..	..	..	..	..	..
R. Kinnard, Maungatua	2·10	2·35	2·25	2·25	2·40	2·30
Mrs. Manson, Enfield ..	1·10	1·22	1·22	1·12	1·22	1·15
A. Tweed, Moneymore ..	1·82	1·85	1·85	2·00	2·00	2·00
J. Williamson, Bortons	0·62	0·82	0·65	0·60	0·72	0·62
Total Yield for Three Seasons.						
D. Smollett, Awamangu	6·30	6·61	8·22	7·13	7·98	8·47
R. G. Borrie, Papakaio	1·12	1·85	1·22	1·30	2·06	1·32
R. Kinnard, Maungatua	6·81	8·18	7·81	7·58	8·62	8·16
Mrs. Manson, Enfield ..	3·00	4·13	3·20	3·03	4·07	3·21
A. Tweed, Moneymore	4·70	5·18	5·05	4·93	5·37	5·20
J. Williamson, Bortons	1·20	3·35	1·38	1·23	3·20	1·83

* Area not harvested.

Remarks on Table 1 : Taking individual results, it will be observed that where superphosphate plus lime was applied, in the case of five experiments this mixture gave the highest yield. In the case of the trial on D. Smollett's farm at Awamangu, basic slag plus lime gave a higher aggregate yield than super plus lime. The results obtained from super and super plus lime on the remaining five trials were much more striking than those obtained from slag alone or slag in conjunction with lime. This confirms the general observation that on the average type A pasture superphosphate either alone or in combination with lime can be relied upon to give excellent results. It is to be noted that the greatest increases were obtained during the first year when the fertilizers were applied. Further, although the general hay production was higher during the second year on account of seasonal

effects, a considerable levelling down occurred in regard to the plots receiving fertilizer. During the third season very little differences from the variously treated plots were observed. It has also to be recorded that where increases in weights were obtained, such increases were invariably due to the growth of clover, the grasses being stimulated only to a comparatively small extent. The effect of lime top-dressed alone, while apparent, was not marked.

The following table summarizes the results obtained on type A pastures, giving the average yield from the different treatments during the first, second, and third harvest years; also the average annual yield of hay.

Table 2.—Summary of Results of Hay Manurial Trials on Type A Pastures.

Treatment.	Yield in Tons per Acre.							
	First Year.		Second Year.		Third Year.		Average Annual	
	Average of Six Trials.	Relative Yields.	Average of Six Trials.	Relative Yields.	Average of Five Trials.	Relative Yields.	Yield of Hay.	Relative Yields.
Control ..	1·06	100	1·55	100	1·48	100	1·36	100
Super ..	1·78	168	1·73	112	1·61	109	1·70	125
Slag ..	1·39	131	1·73	112	1·61	109	1·57	115
Lime ..	1·17	110	1·66	107	1·59	107	1·47	108
Super and lime	1·85	175	1·80	116	1·68	114	1·77	130
Slag and lime	1·43	135	1·80	116	1·66	112	1·61	118

Experiments on Type B Pastures.

In the case of the nine trials laid down on pastures of type B, six were continued for the full three years, two for two years, and one was harvested only during the first season. The results of these trials are shown in Table 3.

Remarks on Table 3: As is to be expected, the average general production from type B pastures is lower than that obtained on type A pastures, on account of their greater age and less vigorous nature. During the first and second years the results obtained from superphosphate alone and in combination with lime were greatly superior

Table 3.—Results of Hay Manurial Trials on Type B Pastures.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
	First Year.					
J. Crutchley, Kyeburn	0·55	1·95	0·63	0·56	2·08	0·67
S. G. Greer, Patearoa ..	1·87	2·66	2·12	1·80	2·80	2·28
A. C. Hurst, Windsor ..	1·07	1·48	1·20	1·15	1·38	1·25
W. Lusk, Crookston ..	1·13	1·32	1·13	1·08	1·31	1·07
W. McMillan, Herbert ..	0·97	1·25	1·08	1·17	1·28	1·26
I. Revie, Crookston ..	1·42	1·81	1·53	1·38	1·80	1·41
J. Roberts, Middlemarch	0·52	1·21	0·65	0·71	1·16	0·73
D. McG. Reid, Milton ..	1·10	1·58	1·38	1·31	1·88	1·80
H. S. Sheat, Bushey ..	1·46	1·90	1·65	1·62	2·02	1·71

Table 3—continued.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
Second Year.						
J. Crutchley, Kyeburn	0·60	1·00	0·62	0·60	0·95	0·65
S. G. Greer, Pateroa ..	1·50	2·10	1·72	1·42	2·00	1·55
A. C. Hurst, Windsor*	..	..	..	..	..	..
W. Lusk, Crookston ..	1·80	2·31	2·11	1·80	2·01	1·83
W. McMillan, Herbert ..	1·10	1·15	1·12	1·02	1·20	1·10
I. Revie, Crookston ..	0·92	1·50	1·27	0·96	1·42	1·01
J. Roberts, Middlemarch	0·80	0·85	0·82	0·71	0·71	0·75
D. McG. Reid, Milton ..	1·22	1·45	1·42	1·35	1·62	1·55
H. S. Sheat, Bushey ..	0·55	0·95	0·60	0·60	0·70	0·62
Third Year.						
J. Crutchley, Kyeburn	0·70	0·82	0·70	0·70	0·80	0·72
S. G. Greer, Pateroa ..	1·75	2·15	1·95	1·70	2·12	1·82
A. C. Hurst, Windsor*	..	..	..	..	..	..
W. Lusk, Crookston ..	1·70	2·02	1·95	1·72	2·00	1·90
W. McMillan, Herbert ..	0·70	0·80	0·72	0·75	0·85	0·80
I. Revie, Crookston* ..	..	..	..	..	..	..
J. Roberts, Middlemarch*	..	..	..	..	..	..
D. McG. Reid, Milton ..	1·30	1·42	1·40	1·52	1·52	1·60
H. S. Sheat, Bushey ..	0·92	1·00	0·92	0·92	0·92	0·95
Total Yield for Three Seasons.						
J. Crutchley, Kyeburn	1·85	3·77	1·96	1·86	3·83	2·05
S. G. Greer, Pateroa ..	5·12	6·91	5·80	4·92	6·92	5·66
A. C. Hurst, Windsor ..	1·07	1·48	1·20	1·15	1·38	1·25
W. Lusk, Crookston ..	3·63	5·65	5·19	4·60	5·32	4·80
W. McMillan, Herbert ..	2·77	3·20	2·93	2·95	3·32	3·16
I. Revie, Crookston ..	2·34	3·31	2·80	2·34	3·22	2·42
J. Roberts, Middlemarch	1·32	2·06	1·47	1·42	1·87	1·48
D. McG. Reid, Milton ..	3·62	4·45	4·20	4·18	5·02	4·75
H. S. Sheat, Bushey ..	2·93	3·85	3·17	3·14	3·64	3·28

* Area not harvested.

Table 4.—Summary of Results of Hay Manurial Trials on Type B Pastures.

Treatment.	Yield in Tons per Acre.							
	First Year.		Second Year.		Third Year.		Average Annual	
	Average of Nine Trials.	Relative Yields.	Average of Eight Trials.	Relative Yields.	Average of Six Trials.	Relative Yields.	Yield of Hay.	Relative Yields.
Control ..	1·12	100	1·06	100	1·17	100	1·11	100
Super ..	1·67	149	1·41	133	1·37	117	1·48	133
Slag ..	1·26	113	1·21	114	1·27	109	1·24	112
Lime ..	1·20	107	1·05	100	1·22	104	1·15	104
Super and lime	1·75	156	1·32	125	1·37	117	1·48	133
Slag and lime	1·35	121	1·13	107	1·30	111	1·26	114

to the control plots, and to slag when used alone or in combination with lime. At no stage did slag equal the increases obtained from

super, and conclusive evidence was obtained that on pastures of this type, and under the soil and climatic conditions prevailing, superphosphate was superior to slag. Although fairly marked differences were observed during the second season, a general levelling-down took place during the third season. On this type of pasture practically no results of a measureable nature were obtained from the use of lime alone.

Table 4 summarizes the results obtained from type B pastures.

Experiments on Type C Pastures.

Eleven experiments were conducted on type C pastures, and of these all were harvested during the first season, ten during the second season, and six during the third season. Type C pasture represents a large area of Otago's pastoral land, to which many farmers have recently been giving attention by manuring in the hope of making them more productive or at least maintaining their existing productivity. From this point of view it is extremely interesting to note just what results have been obtained from the use of phosphates and lime on this type of pasture. This information is summarized in Table 5.

Remarks on Table 5: There can be no question that the application of superphosphate and super plus lime has clearly demonstrated its superiority during the first and second seasons. Even during the third season, despite the fact that the effect of all fertilizers has largely disappeared, an increase from the use of a combination of lime and super is indicated. The greatest increases occurred during the first

Table 5.—Results of Hay Manurial Trials on Type C Pastures.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
			First Year.			
C. Body, Kelso .. .	0·85	1·06	1·00	0·95	1·06	1·05
Cockburn Bros., Te Houka ..	1·57	2·31	1·81	1·65	2·45	1·83
J. Clarke, Wairuna	1·50	1·72	1·66	1·65	2·15	1·90
A. Craig, Greenfield	0·60	0·75	0·71	0·61	0·75	0·78
M. A. Kinney, Hyde.. ..	0·50	1·16	0·58	0·56	1·21	0·75
W. McMillan, Herbert ..	0·57	0·62	0·55	0·61	0·75	0·75
J. A. Payne, Waikouaiti ..	0·50	0·71	0·63	0·56	0·73	0·58
R. J. E. Smith, Wedderburn ..	0·22	0·43	0·23	0·25	0·45	0·26
A. Spencer, Berwick ..	1·62	2·21	2·08	1·65	2·23	1·92
W. S. Trotter, Hillgrove ..	0·83	1·48	0·93	0·96	1·53	1·08
J. Withers, Maungatua ..	0·98	1·35	1·27	1·00	1·28	1·30
			Second Year.			
C. Body, Kelso	0·60	0·62	0·75	0·60	0·75	0·75
Cockburn Bros., Te Houka ..	0·92	1·05	1·00	0·95	1·10	1·12
J. Clarke, Wairuna* ..	..	..	..	..	..	..
A. Craig, Greenfield	0·72	0·80	0·90	0·72	0·85	0·90
M. A. Kinney, Hyde.. ..	0·70	0·82	0·72	0·76	0·90	0·80
W. McMillan, Herbert ..	0·20	0·20	0·21	0·21	0·20	0·25
J. A. Payne, Waikouaiti ..	0·42	0·42	0·45	0·45	0·40	0·45
R. J. E. Smith, Wedderburn ..	0·65	0·85	0·75	0·72	1·00	0·85
A. Spencer, Berwick ..	2·55	3·12	2·75	2·60	3·22	2·80
W. S. Trotter, Hillgrove ..	0·60	0·60	0·52	0·52	0·55	0·50
J. Withers, Maungatua ..	1·65	1·95	1·95	1·70	1·95	1·90

Table 5—continued.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
Third Year.						
C. Body, Kelso*	..	..	..	..	..	..
Cockburn Bros., Te Houka ..	1·00	1·25	1·02	1·00	1·25	1·00
J. Clarke, Wairuna* ..	..	..	..	..	..	..
A. Craig, Greenfield* ..	..	..	..	..	..	..
M. A. Kinney, Hyde.. ..	1·10	1·02	1·10	1·02	1·10	1·02
W. McMillan, Herbert* ..	..	..	..	..	..	..
J. A. Payne, Waikouaiti* ..	..	..	..	..	..	..
R. J. E. Smith, Wedderburn ..	0·52	0·60	0·57	0·62	0·70	0·62
A. Spencer, Berwick ..	1·50	1·52	1·55	1·50	1·55	1·52
W. S. Trotter, Hillgrove ..	0·85	0·85	0·85	0·90	0·92	0·85
J. Withers, Maungatua ..	1·55	1·62	1·62	1·50	1·55	1·52
Total Yield for Three Seasons.						
C. Body, Kelso	1·45	1·68	1·75	1·55	1·81	1·80
Cockburn Bros., Te Houka ..	3·49	4·61	3·83	3·60	4·80	3·95
J. Clarke, Wairuna	1·50	1·72	1·66	1·65	2·15	1·90
A. Craig, Greenfield	1·32	1·55	1·61	1·33	1·60	1·68
M. A. Kinney, Hyde.. ..	2·30	3·00	2·40	2·34	3·21	2·57
W. McMillan, Herbert ..	0·77	0·82	0·76	0·82	0·95	1·00
J. A. Payne, Waikouaiti ..	0·92	1·113	1·08	1·01	1·13	1·03
R. J. E. Smith, Wedderburn ..	1·39	1·88	1·55	1·59	2·15	1·73
A. Spencer, Berwick ..	5·37	6·85	6·38	5·75	7·00	6·24
W. S. Trotter, Hillgrove ..	2·28	2·93	2·30	2·38	3·00	2·43
J. Withers, Maungatua ..	4·18	4·92	4·84	4·20	4·78	4·72

* Area not harvested.

season after application, with a rapid levelling down taking place during the second season. The effect of basic slag and slag plus lime is noticeable, though to a lesser extent than superphosphate during the first season, but the effect of slag is not materially continued beyond the first season. Lime alone has not appreciably increased the yield of hay during any season under review.

A summary of the yields is given in the following table:—

Table 6.—Summary of Results of Hay Manurial Trials on Type C Pastures.

Treatment.	Yield in Tons of Hay per Acre.							
	First Year.		Second Year.		Third Year.		Average Annual	
	Average of Eleven Trials.	Relative Yields.	Average of Ten Trials.	Relative Yields.	Average of Six Trials.	Relative Yields.	Yield of Hay.	Relative Yields.
Control ..	0·88	100	0·90	100	1·08	100	0·95	100
Super ..	1·25	142	1·04	116	1·14	106	1·14	120
Slag ..	1·04	118	1·00	111	1·12	104	1·05	111
Lime ..	0·95	108	0·92	102	1·09	101	0·98	103
Super plus lime	1·32	150	1·09	121	1·17	108	1·18	124
Slag plus lime	1·10	125	1·03	114	1·09	101	1·07	113

Experiments on Type D Pastures.

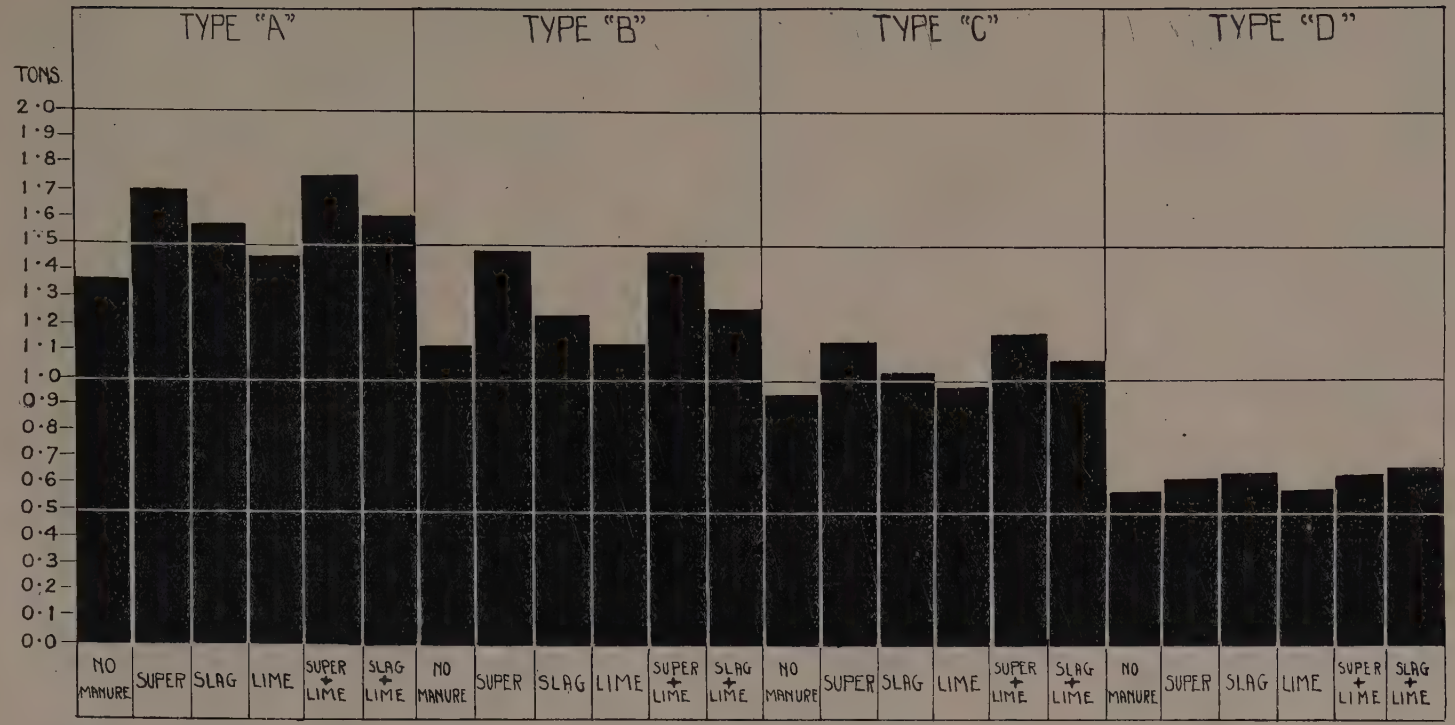
The pastures designated type D were, generally speaking, of low production and comprised chiefly of brown-top. Brown-top occupies a considerable area of South Otago, and many farmers are entirely dependent upon it for grazing. It is of considerable economic importance, and unquestionably, when well controlled, carries a surprising number of sheep, considering its reputed low-feeding value. There is no doubt that by increasing the fertility of the soil, better species of grasses than brown-top can be encouraged to grow on Southern hill country; but as so great an area of the pastures of South Otago are largely composed of this grass, trials under the D series were instituted to determine the effects of manuring on pastures of this type. During the first year seven experiments were harvested, and five during the second season. The trials on this type of pasture were then discontinued, as the results obtained during two seasons did not warrant further continuation.

Table 7.—Results of Hay Manurial Trials on Type D Pastures.

Farmer's Name.	Yield in Tons of Hay per Acre.					
	Control.	Super.	Slag.	Lime.	Super plus Lime.	Slag plus Lime.
First Year.						
J. Cotton, Evans Flat	0·26	0·40	0·31	0·28	0·32	0·31
G. L. Cunningham, Hillend	0·50	0·55	0·56	0·52	0·55	0·55
Major Hickey, Waipahi	0·31	0·53	0·43	0·33	0·58	0·50
S. Ottrey, Heriot	0·55	0·62	0·56	0·58	0·62	0·58
W. B. Paterson, Stuart Downs	0·21	0·28	0·21	0·22	0·31	0·22
R. Thompson, Lawrence	0·82	0·80	1·05	0·90	0·90	1·22
V. Wilson, Greenfield	0·77	0·91	0·78	0·78	0·92	0·82
Second Year.						
J. Cotton, Evans Flat	0·65	0·80	0·82	0·70	0·90	0·85
G. L. Cunningham, Hillend	0·72	0·70	0·72	0·72	0·70	0·70
Major Hickey, Waipahi	0·35	0·41	0·42	0·35	0·42	0·38
S. Ottrey, Heriot*	..	..	..	..	..	..
W. B. Paterson, Stuart Downs	1·10	1·00	1·20	1·02	0·92	1·15
R. Thompson, Lawrence	0·45	0·52	0·60	0·52	0·55	0·65
V. Wilson, Greenfield*	..	..	..	..	..	..
Total Yield for Two Seasons.						
J. Cotton, Evans Flat	0·91	1·20	1·13	0·98	1·22	1·16
G. L. Cunningham, Hillend	1·22	1·25	1·28	1·24	1·25	1·25
Major Hickey, Waipahi	0·66	0·94	0·85	0·68	1·00	0·88
S. Ottrey, Heriot	0·55	0·62	0·56	0·58	0·62	0·58
W. B. Paterson, Stuart Downs	1·31	1·28	1·41	1·24	1·23	1·37
R. Thompson, Lawrence	1·27	1·32	1·65	1·42	1·45	1·87
V. Wilson, Greenfield	0·77	0·91	0·78	0·78	0·92	0·82

* Area not harvested.

Remarks on Table 7: It is quite obvious that on low-production pastures of this nature the application of artificial fertilizer, so far as increased hay production is concerned, is not warranted, and that greater economic results will accrue by applying fertilizers to a better and more productive type of pasture. Very slight gains were received from the application of phosphates and lime, and in the second season



GRAPH ILLUSTRATING ANNUAL AVERAGE HAY PRODUCTION IN THE PASTURE TOP-DRESSING TRIALS OVER THE SEASONS 1927, 1928, AND 1929 (SEE NEXT PAGE).

basic slag, alone and in combination with lime, showed a slight increase which was barely significant. The following tabulation summarizes the two seasons' results :—

Table 8.—Summary of Results of Hay Manurial Trials on Type D Pastures.

Treatment.	Yield in Tons of Hay per Acre.					
	First Year.		Second Year.		Average Annual	
	Average of Seven Trials.	Relative Yields.	Average of Five Trials.	Relative Yields.	Yield of Hay for Two Seasons.	Relative Yields.
Control ..	0·49	100	0·65	100	0·57	100
Super	0·58	118	0·68	105	0·63	111
Slag	0·56	114	0·75	115	0·65	114
Lime	0·52	106	0·66	101	0·59	104
Super plus lime ..	0·60	122	0·71	109	0·65	114
Slag plus lime ..	0·60	122	0·74	114	0·67	118

Summary of Average Annual Yields.

The accompanying graph indicates the value of superphosphate and a combination of super and carbonate of lime for hay production on pasture types A, B, and C. This graph depicts the average annual production—not the total production—obtained from the various fertilizers over the three seasons of the duration of the trials. On account of the general falling-off and levelling-down of all manurial differences during the second and third seasons, the differences in heights of the individual production columns is appreciably lessened, but there can be no question as to the superiority of superphosphate and lime throughout the trials.

Conclusions in Brief.

(1) The experiments conclusively point to the fact (with one exception mentioned)* that superphosphate and carbonate of lime when used in conjunction give better hay yields than superphosphate or basic slag when these are used alone, or than a combination of basic slag and carbonate of lime.

(2) Superphosphate when applied as a top-dressing proved superior to basic slag on all pasture types with the exception of type D, whereon no material differences were recorded.

(3) The effect of dressings of 1 ton of carbonate of lime alone is of a limited nature, in so far as hay production is concerned.

(4) The greatest increases in hay-production occur in the first season, with a rapid falling-off in production occurring during the second and third seasons.

(5) The results indicate that top-dressing should be carried out annually.

Acknowledgment is made to the various officers of the Fields Division in Otago who were responsible for the conduct of the experiments, and to those farmers who co-operated with the Department in carrying the trials through to a successful conclusion.

INFLUENCE OF DIETARY IRON ON HAIR AND WOOL GROWTH.

I. J. CUNNINGHAM, Chemistry Section, Department of Agriculture.

IN this short article it is proposed to indicate—more particularly for the practical wool-grower—some effects of experimentally controlling the amounts of iron in the diets of rats on the growth of their hair coats.

To begin with, young rats were fed a ration very low in iron. The ration was a good one in other respects, being composed of the following materials: Casein 15 per cent., flour 40 per cent., castor sugar 30 per cent., lard 5 per cent., dried yeast 3 per cent., cod-liver oil 3 per cent., mineral mixture (no iron) 4 per cent. This was fed to the maternal animals as soon as the young commenced to share their food, and was continued for the young animals after weaning.

In one experiment twelve young animals were fed in this manner, and thirty-seven days after weaning all had developed extensive hairlessness, a typical illustration of which appears in Fig. 1. Over the same period a practically normal coat was maintained by six similar rats which had received the same ration, but with a daily addition of a very small quantity of limonite (hydrated iron oxide) after weaning. A photo of one of these rats is reproduced in Fig. 2. This result was confirmed in another similar experiment.

In order to test the effect of iron further, some of the hair-deficient rats were fed a daily ration of iron in addition to their low iron diet. In three weeks a normal hair coat had grown, as is seen from Fig. 3 where the illustration is of the same rat as that in Fig. 1.

Throughout the experiments periodic hæmoglobin determinations were made in the blood of all animals, and the results confirmed the view that the practically hairless rats were suffering from lack of iron, while in those which grew a normal hair coat no indication of iron deficiency was found. These conclusions received further support from determinations of the iron content of the livers of the rats at the end of the experiments, as there was much less iron in the livers of the practically hairless rats than in those of rats with normal hair coats.

The possibility of iodine deficiency causing the hairlessness was excluded by the results of feeding potassium iodide to some hair-deficient rats, while histological examination* of the skin of one of the practically hairless animals showed that skin disease had not caused the condition.

It seems, therefore, that one effect of iron deficiency in the rat may be a reduced ability to grow hair. Such an observation is of importance to the wool-grower in New Zealand, for here, as B. C. Aston has shown, large areas exist where the natural source of iron is insufficient for the needs of the animal. It is not suggested that precisely the same conditions surround the growth of hair on the rat as those surrounding the growth of wool on the sheep, but it is likely

* I am indebted to Mr. D. A. Gill, of the Wallaceville Veterinary Laboratory, for making the histological examination.

FIG. 1.

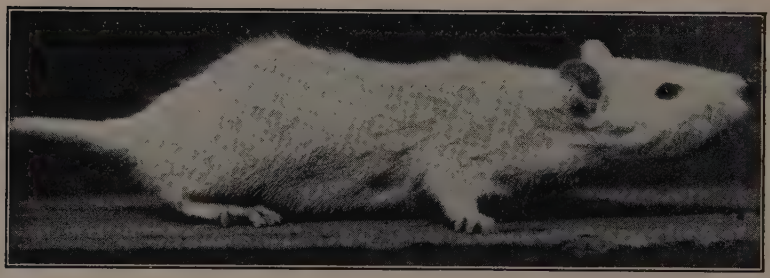


FIG. 2.

FIG. 3.

SOME OF THE RATS IN THE DIETARY IRON EXPERIMENTS.

(See references in text.)

[*Photos. by R. E. R. Grimmett.*

that similar fundamental conditions obtain, and certainly likely that iron may exert an important influence. In this connection T. Rigg (Bulletin 32, New Zealand Department of Scientific and Industrial Research) has observed differences between the fleeces of sheep fed iron supplements and those deficient in iron.

To conclude, the evidence submitted indicates that iron may be an important factor in promoting the growth of wool on sheep in iron-deficient areas. This possibility should be remembered by all wool-growers, and, if necessary, advice may be obtained from Agriculture Department officers as to the best method of administering iron to the flock.

THE TUNG-OIL TREE.

CULTIVATION EXPERIENCE IN NORTH AUCKLAND.

E. T. Frost, Lake Ohia, North Auckland.

Considerable interest is being taken in the planting of the tung-oil tree (*Aleurites Fordii*) in the northern part of Auckland Province. Some thousands of acres have been selected for plantations, and at the present time are being ploughed and cultivated preparatory to the planting-out of the young trees which are now growing in the nurseries. Up to the present the main work has been confined to the nursery, of which there are several, with probably half a million young plants.

There are peculiarities in the germination of the tung seed and the growth of the young plant which have, or should have, a bearing on the selection of a site and the preparation of the ground prior to planting the seed. If possible, it would be wise to prepare the ground a season ahead of the planting in the nursery. A crop of potatoes would prove an excellent way to clean a nursery plot. If this is done, and the ground is kept stirred up regularly after the harvesting of the cleaning crop, the land ought to be reasonably free of weeds by planting-time.

Tung seeds germinate rather unevenly, and, as it will be at least three months after planting before much intercultivation can be carried out, if the ground is not clean there will be a great growth of weeds, which will not only rob the seedlings but constitute a source of danger when weeding does take place.

Shelter is all-important in the nursery. If the young plants are thriving as they ought, three months after coming through they should be between 2 ft. and 3 ft. in height, and making growth vertically at the rate of not less than 3 in. per week. At this stage they will have from fifteen to twenty leaves, the largest of which will be from 10 in. to 12 in. across and about the same length. It will be thus seen that a large surface will be presented to the wind. Later on, as the tree matures, the leaves become smaller.

Some experiments have been carried out with seedlings in exposed positions, and it is interesting to note that they are very tough and stand up well to severe conditions; but, of course, as with most other trees, shelter will greatly assist the growth, and the risk of blossoms being damaged will be greatly minimized.

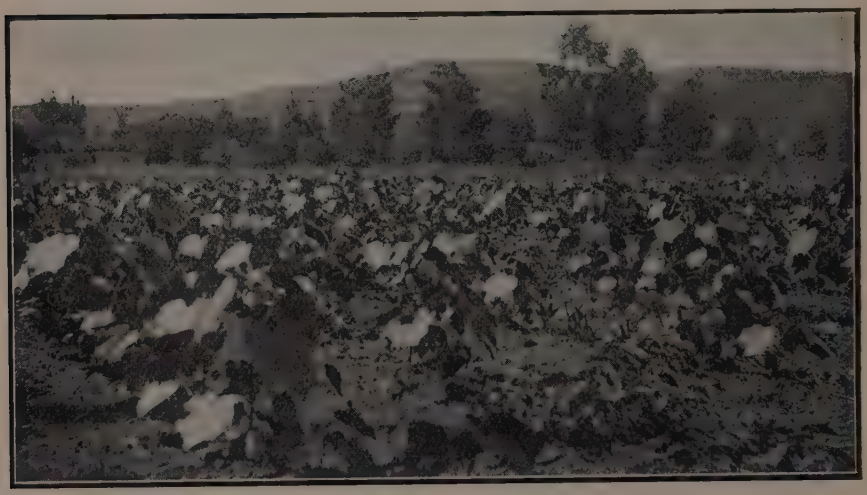


FIG. 1. PART OF TUNG PLANT NURSERY, NEAR MANGONUI.
Seed sown 6th September, 1931; photo taken 6th March, 1932.

FIG. 2. TUNG PLANT IN THE NURSERY, 3 FT. HIGH.
Seed sown 26th August, photo taken 6th March.

In the nursery under consideration, situated near Mangonui, the first planting of seed was made on 15th August last and several days following. A second lot was planted a fortnight later, and the main area, some 3 acres, was planted early in October. The quickest and most regular germination took place in the last planting, although the second one was nearly as good. The first planting was slower in germinating, but at time of writing (end of March) it is making good headway, and will probably by the beginning of the winter be almost as forward as the main planting.

From this one would deduce that there is nothing to be gained by early planting. The seeds evidently require a certain earth temperature to start them. Some seeds planted in May did not show through until November. The average time for germination of the August planting was fifty-six days, while that of the October planting was not over forty-five. The land is alluvial river silt, well sheltered, and underground drains have been laid to take surface water off quickly. Many of the plants at three months old are 3 ft. high, and the average would be at least 2 ft. The growth as measured on a number of plants is over 4 in. in height per week. The stems are averaging ½ in. diameter 2 in. above the ground.

Intercultivation of the nursery must be done with the greatest care, as many seeds may be just about to push the plumule above ground, and at this stage can be easily damaged. Weeding will be greatly facilitated if the seeds are planted to exact measurements, as a plant above the ground in the early stages gives the exact location of those on either side of it, and by careful working (if it is imperative to weed at this stage) these positions can be noted.

The nursery under consideration was laid out in 3 ft. rows, with 12 in. between plants. No closer planting could be recommended if growth is going to be on a par with that of plants in this district. This leaves enough space for horse or mechanical cultivation between rows in the early stages.

This nursery area, being good-quality land, was not fertilized at time of planting, but a small application of blood and bone and guano was applied after weeding. Germination has been very good, in many cases being from 75 to 80 per cent., and practically all the plants are showing excellent virility. The seed was given no special preparation. Part of them were hulled three months previous to planting, and the rest were hulled and planted right away. No variation was noticed in the germination of any of the lots.

The ground was opened up with a hoe to depth of about 2 in. to 3 in., the seeds placed in to gauge, and the row covered again with a hoe. A stake was left at the end of each row as an indicator, and proved useful as a guide in the early stage of horse cultivation. The mechanical cultivator has not yet been tried, but possesses advantages over the horse, and will probably be used to a great extent in these nurseries another season.

To summarize—after a year's experience with tung plants, one can safely lay down the principles of a summer fallow and adequate shelter as conducive to the best results. Further, if these principles are extended to the plantation subsequently the tung plant should thrive in the congenial climate of North Auckland.

IMPORTATION OF FERTILIZERS IN 1931-32.

R. E. R. GRIMMETT and J. A. BRUCE, Chemistry Section, Department of Agriculture.

THE usual annual summary of comparative import statistics compiled from data furnished by courtesy of the Comptroller of Customs is presented in the attached tabulated statements. These refer in some detail to prepared fertilizers and materials for fertilizer manufacture entering the Dominion during the year ended 31st March, 1932.

The returns exhibit a reduction in tonnage in almost all items, though an appreciable increase is manifested in deliveries of raw phosphate rock from Nauru and Ocean Islands. A small rise is also noted in the receipts of nitrate of soda from Chile. Notwithstanding the substantial decreases shown, some satisfaction can be derived from the fact that the total quantity of all fertilizers imported, amounting to 241,843 tons in the year under review, although considerably below the total tonnages of 262,442 and 368,762 for the respective years 1930–31 and 1929–30, is still well above the level of importations for the years 1924–25 and 1925–26. During these two years of comparative agricultural prosperity the total importations were only 167,462 tons and 174,768 tons respectively.

As might have been expected, there was a continuation of restricted and cautious importation evident from the preceding year's statistics. This policy was doubtless chiefly due to the adverse agricultural conditions which has led many users to economize to a certain extent in fertilizer purchases. The unsettled exchange position and the generally unsatisfactory market conditions were also contributory factors in causing a shrinkage in imports. Items showing the most decided reductions or changes in the importation position are briefly discussed under the following heads.

Phosphates.—Apart from the Nauru and Ocean Islands rock, which has not only felt the effect of enforced economy least of all but has shown an improvement of 28,582 tons, or 24 per cent., over last year's quota, practically every item in this group has registered comparatively large losses. Bonedust, the importation of which has lately been prohibited, has dwindled to an insignificant amount of only 160 tons. The retrograde movement in importation of basic slag apparent in 1930–31 was continued in a pronounced manner during the year, partly accountable for which was both the shortage of supplies through inactivity of the steel industry and the unstable foreign exchanges. Over 9,000 tons of slag were from Great Britain—an increase of 50 per cent. over last season's receipts from this source. Much better grades of "open hearth" slag, with a higher percentage of citric-soluble phosphoric acid plant-food than was the case for a good many years past, are now on the British market. The probability is that the current year will see a further expansion of the importation of this commodity from Britain to the Dominion.

Another outstanding feature is the absence of raw phosphates imported direct from North African mines—in Morocco, Tunisia, and Egypt—in the past twelve months. In former years all three countries have participated prominently in supplying New Zealand with phosphates for direct application to the land. Possibly some of the phosphate from the large Gafsa mines in Tunisia, usually ground in Belgium or elsewhere in Europe, may be included under the description "Phosphate not otherwise specified."

Undoubtedly the stimulus to the domestic consumption of high-grade superphosphate (20·1 per cent. of phosphoric acid plant-food) occasioned by a State subsidy of 12s. per ton on its selling-price has considerably influenced the import position of basic slag and other commodities in the phosphate class.

Nitrogen.—Despite concentrated efforts being made by certain organizations in the direction of increasing the quantity of inorganic nitrogen fertilizers used chiefly in pasture production in this country, the year witnessed a considerably smaller importation of sulphate of ammonia than in the two preceding years. A slight increase, as already pointed out, is apparent in the case of Chilean nitrate of soda, a certain amount of which is employed for chemical manufacture.

Potash.—Imports of various grades, which showed a rapid relative rise to a maximum of 13,429 tons in 1928–29, suffered a further decline to

TABLE I. — SUMMARY OF FERTILIZER IMPORTATIONS, 1931–32 AND 1930–31.

Fertilizer.	Quantity.		Declared Value.*	
	Year 1931–32.	Year 1930–31.	Year 1931–32.	Year 1930–31.
	Tons.	Tons.	£	£
Bonedust and bone-char ..	180	795	993	6,964
Basic slag	47,776	67,766	119,191	189,091
Superphosphate (concentrated) ..	300	..	2,014	..
Nauru and Ocean Islands phosphate	148,060	119,478	198,842	141,090
Island phosphate (other)† ..	30,406	37,472	44,800	61,652
Moroccan phosphate	..	8,038	..	10,919
North African phosphate (other)	..	250	..	505
Phosphate (not otherwise specified)	4,738	13,405	12,378	33,708
Kainit	334	997	971	2,752
Muriate of potash	65	50	844	394
Sulphate of potash	648	1,310	6,867	13,631
Potash salts (other)	3,581	5,833	16,480	26,161
Sulphate of ammonia	4,785	6,170	38,160	58,510
Nitrate of soda	920	754	7,915	7,628
Cyanamide	..	30	..	255
Sulphate of iron	45	2	233	20
Fertilizers unspecified	5	92	101	1,180
Totals	241,843	262,442	449,789	554,460

† Includes phosphate from Tuamotu Archipelago, Seychelles Islands, New Caledonia, and Madagascar (for details see Table 3).

* NOTE.—The values shown in the above table are those declared for Customs purposes, and represent the current domestic values in the countries of exportation, plus 10 per cent.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1923–32.

Year ended 31st March,	Bonedust and Bone-char.	Basic Slag.	Super-phosphate.	Pacific and Indian Oceans Phosphate.	Egyptian Phosphate.	Moroccan Phosphate.	North African Phosphate (other).
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1923 ..	2,446	19,641	..	69,591	..	..	..
1924 ..	4,158	39,632	255	76,517	5,996	..	..
1925 ..	2,452	45,682	10	108,163	8,530	..	..
1926 ..	2,085	44,314	500	97,488	10,037	..	..
1927 ..	1,805	53,327	15	161,541	5,979	..	..
1928 ..	725	48,913	6,616	143,373	6,603	13,389	..
1929 ..	554	93,222	1,037	178,057	6,000	22,173	12,499
1930 ..	1,420	94,332	525	170,997	1,000	35,348	37,424
1931 ..	795	67,766	..	156,950	..	8,038	250
1932 ..	180	47,776	300	178,466	..	..	..

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL COMMERCIAL FERTILIZERS FOR YEAR 1931–32, SHOWING COUNTRIES OF ORIGIN AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Chile.	India.	Australia.	Pacific and Indian Ocean Islands.		Great Britain.			Belgium.			France.			Germany.			Netherlands.			Poland.
	Nitrate of Soda.	Bonedust.	Bone-char.	Source.	Raw Phosphate.	Sulphate of Ammonia.	Basic Slag.	Phosphate.	Basic Slag.	Phosphate.	Potash.	Basic Slag.	Phosphate.	Potash.	Basic Slag.	Superphosphate (Double).	Potash.	Basic Slag.	Superphosphate (Double).	Phosphate (Mineral).	Potash.
Auckland ..	655	140	..	Nauru/Ocean ..	90,363	2,515	3,279	15	23,704	1,970	15	50	..	895	50	..	1,275	300	50	700	277
				Tuamotu	6,094																
				Seychelles ..	2,957																
New Plymouth	90	..	..	Nauru	11,554	275	4,478	..	9,194	950	100	..	..	98	..	..	50	..	..	..	175
				Tuamotu	3,438																
Wanganui ..	..	..	..	Nauru/Ocean ..	14,428	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
				Tuamotu	3,268																
				New Caledonia ..	1,477																
Napier ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..
Wellington ..	10	..	..	..	..	600	920	23	2,836	100	5	..	..	95	..	..	400	..	..	..	195
Nelson ..	..	..	..	..	..	75	..	5	730	100	..	..	..	10	..	..	40	..	..	..	25
Lyttelton ..	40	15	..	Nauru/Ocean ..	8,978	375	..	..	100	..	15	..	..	30	..	100	92	..	25	..	10
				Tuamotu	1,501																
				New Caledonia ..	1,400																
				Madagascar ..	793																
Timaru ..	..	..	..	New Caledonia ..	723	30	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..
Dunedin ..	125	5	..	Nauru/Ocean ..	22,737	675	..	..	250	375	..	25	25	194	..	..	215	..	125	..	10
				Tuamotu	1,937																
				New Caledonia ..	748																
				Madagascar ..	2,428																
Invercargill ..	..	..	20	Seychelles	3,642	240	495	165	1,365	160	..	..	..	240	..	..	135	..	..	100	25
Totals ..	920	160	20	..	178,466	4,785	9,172	208	38,179	3,705	135	75	25	1,562	50	100	2,211	300	200	800	717

4,628 tons during the year 1931–32. An amount of 717 tons came from Poland, a new source of supply for New Zealand. Only relatively small quantities of potash, chiefly in the form of potash (chloride) salts, as yet find application in our local farm practice. The principal use of the potash-bearing fertilizers is for incorporating in proprietary mixed manures, for grassland top-dressing and orchard culture.

General.—It may be of interest to mention that the percentage of prepared fertilizers imported either for direct application to the soil or for mixing purposes now approximates 33 per cent. of the total importations, while fertilizer materials, chiefly in the form of raw phosphates for superphosphate manufacture, amount to 67 per cent. or thereabouts. The percentage decreases in the totals of each group compared with last year are: Phosphatic fertilizers, 6·4 per cent.; nitrogenous, 18 per cent.; potassic, 43·5 per cent.

TREATMENT OF DEVITALIZED APPLE-TREES.

M. Davey, Orchard Instructor, Mapua.

Throughout the commercial fruit-producing districts of New Zealand, and especially in those areas where orchards have been established on hilly or second-class land, there exist a large number of individual apple-trees which have declined in vigour, ceased their development of wood growth, and whose carrying-capacity shows no profit over the cost of production. In most cases this class of tree can be avoided by judicious treatment and special attention from the time at which full cropping commences. When debility has been established for some considerable period, correction or rejuvenation of the tree is more difficult and often a slow process. However, it is seldom that the condition cannot be materially modified if not entirely eliminated.

Generally speaking, the direct cause or causes of debility are not difficult to ascertain and remedy. The chief factors operating comprise the following—(1) Insufficient nutrition; (2) neglect to maintain a healthy condition of foliage; (3) overcropping; (4) lack of conservation of soil moisture; (5) indifferent drainage. These subjects will be briefly dealt with seriatim.

Nutrition.

In cases coming under this heading it is recommended that special treatment with manures be the first aim, with the object of stimulating and increasing the green tissues throughout the tree represented by its annual extensions of growth and the leaf system. To achieve this object recourse must be made to fertilizers rich in nitrogen and of a highly soluble nature. Ranking first among such manures are sulphate of ammonia and nitrate of soda. On present market values sulphate of ammonia commands consideration, providing as it does the maximum nitrogen content at the lowest unit cost. An effective and not excessive application of 4 lb. to 6 lb. of this fertilizer per tree in early winter may be expected to greatly stimulate growth during the ensuing season. The acidifying effect of the manure may be no disadvantage; but if such is considered to be the case a top-dressing of 1 lb. of nitrate of soda applied in early spring will tend to neutralize this effect.

When a pronounced extension of growing terminals has been realized, and the foliage has shown a marked increase in leaf surface, a return to complete fertilizers is advisable; phosphatic manures stimulate the root system, while potassic manures tend to tone up the tree and refine the fruit.

It may be noted that stimulation of those parts of the tree above ground will automatically induce a healthy demand on the roots, the excitement of which should lead to extensions into ground which has not previously been explored by the root system.

Maintenance of a Healthy Leaf System.

Neglect to maintain a healthy condition of foliage is probably one of the most common and serious causes of debility in apple-trees, and does not appear to exercise the minds of orchardists to the extent that is warranted. Although most instances of spray burn are attributed to the caustic nature of the compounds applied, in very many instances burning is only secondary to the impoverished condition of the foliage previous to the application of the spray. Failure to appreciate the devitalizing effects of heavy infestations of red-mite and apple leaf-hopper may be regarded as one of the weakest links in commercial fruitgrowing in the past. Until recently adequate control of these two insects has been costly and difficult, but with the advent of emulsified oils which can be used with safety during the late summer the position has been greatly relieved.

Practical experiments carried out by the Horticulture Division during the last two seasons with summer applications of emulsified oils have established the fact that not only can effective controls be obtained, but that other benefits are also derived. It has been indicated that one application of oil causes a partial if not entire suspension of feeding by the insects, enabling the leaves to accumulate and restore a substantial amount of the depleted chlorophyll. The freshening of the foliage also suggests that excessive transpiration is partly suspended by the film of oil covering the leaves.

It is all important that orchardists whose sole anxiety in the past has been to keep the fruit free from deposition of red-mite eggs should realize that the maintenance of a generous and vigorous leaf system for the natural period subsequent to leaf fall is an important factor in building up the development of fruit buds for the following season. Where red-mite is prevalent—and it is common in most districts subject to dry climatic conditions—orchardists are earnestly recommended to consider applications of oil sprays to each variety immediately after harvesting that variety, and thus minimize the adverse effects referred to.

Prevention of Overcropping.

It may be truly said that overcropping is a fruitful source of depletion of the vigour of many trees. Reflection will remind one of the fact that the modern apple-tree is a highly developed organism, vastly different in many respects to its original parent. Commencing life budded or grafted on to the root of other selected varieties, it is handicapped at the start by an interrupted root-system. Prior to man's interference with the original type by selection and hybridization the fruit was approximately one-tenth of the size of that now produced

on most modern varieties. To be consistent with these radical changes in type, control or limitation of the crop becomes a necessity for the commercial orchardist.

Apple-trees, unfortunately, in common with a great number of other plants, become more fruitful as vigour declines, rendering it incumbent on the grower to offset this tendency by preventive measures. In advanced stages of debility the most effective and rapid measure is to entirely remove at pruning period all fruit spurs, cutting back to within ½ in. of the branches from which the spurs have grown. This may appear an extreme or drastic process, but experience shows that entire removal of crop is seldom attained, many fruits being produced on adventitious growths the first season after treatment. In many cases by the second season the tree will be carrying a quantity of fruit equal to the amount produced prior to treatment.

Where debility is not so far advanced or pronounced judicious thinning at fruit-set may be sufficient; reduction of the clusters, or thinning to one fruit per cluster, should serve the purpose. It may be noted that in most instances a reduction of fruit spurs during the dormant season, and consequent limitation of blossom, will often effect a more prolific setting of fruit than would occur if no restriction of bloom had been imposed.

Conservation of Moisture.

Dealing with lack of sufficient moisture, it should be borne in mind that the roots of plants absorb most food substances in liquid form by the process termed osmosis. When the moisture content falls below a given point the function of osmosis is greatly reduced or ceases. With sufficient moisture many insoluble plant nutrients which occur in the soil are made soluble and available to the tree by the action of soil acids. Also, organic acids secreted by the roots, and which act as solvents of insoluble matter, are impotent in the absence of moisture. For these substantial reasons it may be accepted that a uniform and sufficient moisture content is essential to healthy growth. In most instances weak trees are shallow-rooted, and for that reason it is imperative that an effective mulch be maintained in order to bring the action of capillarity close to the surface.

Adequate Drainage.

The importance of adequate drainage need hardly be stressed when one considers the influences brought to bear by it on the soil. The penetration of plant-foods to the subsoil is largely dependent on the percolation of rainfall. Drainage raises the temperature of the ground, thereby causing an early spring growth of the tree. Aeration of the soil, which follows displacement of surface water, is essential to those micro-organisms which exert considerable beneficial influences on the plant. Indifferent drainage allows accumulation of substances which are toxic to plant-life.

Sheep wintered on Oat Silage.—Last year a farmer at Te Wharau, Wairarapa, wintered 600 two-tooth wethers on oat silage, carrying them through in good store condition with a ration of about 3 lb. per head daily. The silage was fed out on a bare rape paddock.

FARMERS' FIELD COMPETITIONS.

TARANAKI, WELLINGTON, AND HAWKE'S BAY DISTRICTS, SEASON 1930–31.

R. P. CONNELL, Fields Division, Department of Agriculture, Palmerston North.

THE Taranaki, Wellington, and Hawke's Bay Districts farmers' field competitions in the 1930–31 season were of the same general nature as those of recent previous years. The total number of entries judged was greater than in any earlier season. The following notes place on record the main features and results of the work.

The entries judged in each of the several districts during the season under review and 1929–30 were as follows:—

	1930–31.	1929–30.
North Taranaki	306	327
South Taranaki	190	143
Wanganui	22	32
Feilding	10	11
Wairarapa	17	4
Hawke's Bay	15	6
Total	560	523

Apart from a Hawke's Bay competition, in which five entries were judged, the ensilage competitions were confined to Taranaki, where they are growing in popularity, as may be seen from the following figures relative to the number of entries judged: 1926–27, 37; 1927–28, 67; 1928–29, 130; 1929–30, 191; 1930–31, 222.

In general there was a falling-off in root-crop entries in 1930–31, which in Taranaki was more than counterbalanced by an increase in ensilage entries. This is a continuation of a tendency which was discussed in the report of the 1929–30 competitions, and which was attributed to the more general and live interest in ensilage methods.

MANGELS.

The mangel-growing competitions for all districts resulted as follows:—

Table 1.

Season.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
1928–29	92	59	14
1929–30	86	58	12
1930–31	66	53	0

The results in each district are indicated in Table 2.

The heaviest crop in the competitions was one in the Wanganui district, which was grown by H. G. Burch, Maxwell, and which yielded 88 tons an acre. This was a Prizewinner Yellow Globe crop sown on 30th October, each acre receiving 5 lb. of seed and 10 cwt. of a mixture of superphosphate and bone fertilizer. The land, which grew swedes in the 1929–30 season, was ploughed on 20th September.

Table 2.

District.	Season 1930–31.			Season 1929–30.		
	Number of Entries judged.	Yield per Acre.		Number of Entries judged.	Yield per Acre.	
		Tons	cwt.		Tons	cwt.
North Taranaki	21	54	18	34	55	15
South Taranaki	20	55	6	24	63	19
Wanganui	11	53	11	18	60	12
Feilding	7	50	14	7	52	14
Hawke's Bay	7	44	15	3	49	13

In North Taranaki the heaviest crop was one of 85 tons per acre, grown by E. C. Eversfield, Ratapiko. Prizewinner Yellow Globe seed at 6 lb. per acre was sown on 4th November in drills 18 in. apart; 5 cwt. of a root-crop manure and ½ ton of salt per acre were used. The land was ploughed out of grass early in August, and disked and harrowed several times in September and October, while, subsequent to sowing, the crop was intercultivated three times.

In South Taranaki the heaviest crop was a Prizewinner Yellow Globe yielding 71 tons per acre, grown by A. T. Burke, Lowgarth. It was sown on 4th December in drills 14 in. apart, 4 cwt. per acre of root manure being used.

In Feilding the winning crop was one of 67 tons per acre, grown by T. Craine, Cheltenham. Prizewinner Yellow Globe seed at 5 lb. per acre was sown in drills 28 in. apart, on 24th October, with 5 cwt. of root manure.

In Hawke's Bay the winning crop of 48 tons was grown by K. R. Gundersen, Norsewood, who on 1st November sowed 4 lb. of Yellow Globe seed in drills 24 in. apart and used 15 cwt. of fertilizer per acre.

SWEDES.

The swede-growing competitions for all districts resulted as follows :—

Table 3.

Season.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
1928–29	120	38	14
1929–30	69	44	17
1930–31	95	47	2

The results in each district are shown in Table 4.

The heaviest crop in the competitions, yielding 71 tons, was grown by G. H. Bell, Oakura, North Taranaki. Half the land occupied by the crop had been previously a pig paddock and other half a bull paddock. On the former portion the crop yielded 83 tons per acre and on the latter portion 59 tons. The land was ploughed in October, disked five times, harrowed twice, and rolled twice. On 14th December,

Table 4.

District.	Season 1930–31.			Season 1929–30.		
	Number of Entries judged.	Yield per Acre.		Number of Entries judged.	Yield per Acre.	
		Tons	cwt.		Tons	cwt.
North Taranaki	39	46	6	47	46	10
South Taranaki	33	46	6	15	41	0
Manawatu	3	50	0	3	28	15
Wairarapa	17	50	10	4	51	8
Hawke's Bay	3	30	0	..	..	

14 oz. of Superlative seed was sown through every coulter of a grain drill, with a turnip manure at the rate of 2 cwt. per acre.

In South Taranaki the winning crop, of 60 tons, was that of A. Johnson, Lowgarth. About mid-December 12 oz. of Masterpiece seed was sown in drills 7 in. apart, 6 cwt. per acre of a mixture of bonedust and superphosphate being used.

In Feilding district the heaviest crop of 66 tons was grown by E. M. Hare, Cheltenham. On 17th December 10 oz. of Masterpiece seed was sown in 14 in. drills, 3 cwt. per acre of Ephos phosphate being used.

In Wairarapa the heaviest crop, 67 tons, was grown by J. Wilson, Mount Bruce, who sowed 16 oz. of Superlative in 7 in. drills, using 3 cwt. per acre of swede manure.

In Hawke's Bay the heaviest crop, 35 tons, was grown by J. Hulena, who sowed 10 oz. of Superlative in 9 in. drills, using 1½ cwt. per acre of superphosphate.

Carrots.

The carrot-growing competitions for all districts resulted as follows :—

Table 5.

Season.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
1928–29	39	41	7
1929–30	52	42	7
1930–31	43	45	11

The results in each district are given in Table 6.

The heaviest crop in these competitions was grown by K. Muggeridge, Auroa, South Taranaki, and yielded 68 tons an acre.

In North Taranaki the heaviest crop, grown by Andrews and Osborne, Huirangi, yielded 67 tons. On 3rd December 2 lb. of Guerande seed was sown in 14 in. drills. In addition to ensilage wastage and farmyard manure, the land received 3 cwt. per acre of superphosphate.

In the Wanganui district the winning crop of 52 tons was grown by H. G. Burch, Maxwell, who sowed 2½ lb. of Guerande on 30th

Table 6.

District.	Season 1930–31.			Season 1929–30.		
	Number of Entries judged.	Yield per Acre.		Number of Entries judged.	Yield per Acre.	
		Tons	cwt.		Tons	cwt.
North Taranaki	12	45	0	14	39	19
South Taranaki	20	50	8	23	47	12
Wanganui	11	37	1	14	37	11
Feilding	..	..		1	22	10

November, and used 10 cwt. of a mixed superphosphate and bone manure.

Soft Turnips.

The only competiton for soft turnips—that in South Taranaki—was won by H. D. Johnson, Lowgarth. His crop of 52 tons per acre was Hardy Green Globe, sown on 7th November, in 7 in. drills, 14 oz. of seed and a mixture of superphosphate and blood and bone being used.

In 1930–31 eight crops averaged 41 tons; in 1929–30 eight crops averaged 46 tons.

Chou Moellier.

In South Taranaki three crops of chou moellier were judged. The winning crop of 45 tons, grown by A. T. Burke, Lowgarth, was sown on 1st December in 7 in. drills, 1½ lb. of seed and 4 cwt. of root manure per acre being used.

Ensilage.

In Taranaki ensilage very usefully occupies a prominent and growing place in the competitions. In North Taranaki in the 1930–31 season 137 entries were judged. Results are indicated in the following table :—

Table 7.

Class.	Number of Entries.	Winner.
Stack (grass)	86	G. F. Mehrtens, Inglewood.
Stack (other than grass)	9	W. Bridgman, Okato.
Hillside stacks	9	F. Bracegirdle, Kaimata.
Earth pits	28	A. R. Bayly, Omata.
Concrete pits	5	J. Cloke, Lepperton.

In South Taranaki 71 entries were judged. The results were as follows :—

Table 8.

Class.	Number of Entries.	Winner.
Stacks	49	W. Lyndon, Auroa.
Pits	17	J. Deegan, Auroa.
Hillside stacks	5	W. T. Seed, Matapu.

In Hawke's Bay five ensilage entries were judged, the winners being K. R. Gundersen, Norsewood (pit), and F. Merrick, Norsewood (stack).

Hay.

In Taranaki haymaking competitions are popular and instructive. In the North Taranaki district 39 entries were judged, the winner being L. Marfell, Toko. In South Taranaki 34 entries were judged, the winner being Hooker Bros., Matapu.

Pastures.

In North Taranaki pasture competitions are creating much interest and serving a valuable purpose in directing attention to good standards of pasture management. Regarding this competition in 1930-31 Mr. J. M. Smith, Fields Division, New Plymouth, reports :—

The competition for dairy pastures attracted 102 entries, and was won by Mr. G. F. Mehrtens, Inglewood.

The points allocated were the same as for the previous season—namely, good grasses, 30 ; clovers, 25 ; inferior grasses, 5 ; freedom from weeds, 10 ; denseness of sward, 15 ; utilization, 15 : total, 100. These points appear to be fairly satisfactory. For the good grasses those species which score highest are perennial rye, cocksfoot, Poa trivialis, timothy, and dogstail. It is necessary to have not only these species present, but that the individual plants should be good leafy specimens. Next to these grasses comes Poa pratensis, a grass which, while of fair quality, occupies far too much space on our pasture lands. As far as clovers are concerned, a variety is desired, just as a good variety of species of grasses is required, only with the clovers we have not such a number of varieties to select from. Some consideration must be given to inferior grasses such as vernal, fog, &c., as it must be recognized that it is better to have the ground occupied by these species—low in production though they are—than to have the ground bare or occupied by weeds. Denseness of sward is also very desirable in the interests of high production, and the pastures should be as free from weeds as possible. The last points are given to utilization, these points indicating the degree of success achieved so far as stocking is concerned.

The entries show a very decided increase on previous years, which is an indication that farmers appreciate the value of this competition. The total entries of 102 compare with 50 in 1929-30. Details of entries are as follows (the previous year's entries being added in parentheses) : Inglewood, 12 (17) ; Huirangi, 12 (11) ; Urenui, 17 (10) ; Kaimata, 11 (6) ; Lepperton, 7 (4) ; Tikorangi, 10 (2) ; Okato, 16 (0) ; Toko, 5 (0) ; Tarurutangi, 8 (0) ; Warea, 4 (0).

ULTRA-VIOLET LIGHT TESTS ON SAMPLES OF RYE-GRASS SEED.

In connection with the Official Seed-testing Station at Palmerston North, it has been decided that all ultra-violet light tests on samples of rye-grass —with the exception of those submitted for official purposes by officers of the Department of Agriculture—will be charged for at the rate of 2s. 6d. per test.

Samples on which fees are chargeable should be submitted either direct to the Seed-testing Station or through an office of the Department of Agriculture, and in either case they must be accompanied by the necessary fees.

SEASONAL NOTES.

THE FARM.

Some Vital Aspects of the Farming Position.

At this juncture, mainly because of the importance of the issues involved, it seems opportune to survey briefly the general farming position in so far as it is relevant to the planning of farm work for the coming few months. Of the matters which demand attention three only will be considered now.

In the first place, primarily because of the general low level of prices of farm-produce, there is greater need than has been felt for many years for increased production, provided it is secured on a sound economic basis.

Secondly, because of recent widespread adverse conditions, there is a possibility of decreased rather than increased production unless the measures adopted in the near future are more thorough than those it has been customary to adopt in the past.

Thirdly, while the New Zealand farming community has attained a relatively high standard of efficiency in the use of material resources, such as machinery, manures, and seeds, it is extremely doubtful whether our available human resources are being exploited with equal efficiency—a matter of paramount national importance in view of current unemployment problems. There is considerable evidence that many farmers have exercised parsimony rather than economy in regard to labour utilization. Two very important classes to which this seems to apply are producers of butterfat and of fat lambs.

It is known, for instance, that while certain dairy-farmers realize they could steadily increase their production to a fairly substantial extent they purposely refrain from attempting to do so, principally because any attempt would involve the employment of another farm hand. In view of the present position of the labour-market such farmers should ask themselves seriously and carefully whether their attitude can be justified economically. There is much evidence that without any considerable direct expenditure on material, and as the result merely of the better attention that more labour would make possible, the production of many herds could in the course of one season be materially increased. Often better feeding by means of the growing of suitable arable crops, by means of ensilage, or by means of cognate measures, would directly make possible a 25-per-cent. increase in production. Often the labour cost is practically the total cost of such measures—a cost which would be recovered in the value of the additional produce. Dairy-farmers as a class need to ask themselves frankly whether they are utilizing effectively the fruits of expenditure on such matters as suitable top-dressing and good herds, when they tolerate on their farms the winter hardships to stock of all types, the unsatisfactory summer feeding of dairy cows, and the all-year-round poor utilization of by-products, which extra labour would enable them almost wholly to avoid.

In the sphere of fat-lamb production instances could be cited in which certain farmers are carrying two to three ewes for every one carried on a unit of similar land by many of their neighbours. When the methods employed on the farms of high carrying-capacity are examined and compared with those used on the farms of low carrying-capacity, it is often to be found that the differences which exist arise from differences in labour utilization, and that the farms employing relatively the greater amount of labour return the greater profits.

When the employment of additional labour is suggested to farmers they often give a reply which is based on a considerable amount of truth, to the effect that domestic more than financial considerations deter them from employing as much labour as they would expect to be profitable. In other words, on many farms the matter of feeding and housing permanent or even casual labour is felt to be a real difficulty.

This difficulty, probably the greatest real one operating against the freer use of labour on farms which are devoted mainly to butterfat or fat-lamb production, promises to be eliminated in the near future. But it will be eliminated only if the farmers concerned give to the recently announced "Small-farm plan" that measure of effective support which intrinsically it deserves. If thoughtful farmers visualize correctly the adequate operation of the small-farm plan in their own district, they will picture the permanent and convenient location of a supply of labour skilled in the farm operations of the neighbourhood—a supply of labour which will obviate the necessity of the wasting of time and money which is involved in the present system of haphazardly drawing upon relatively distant sources of labour of (at times) an unknown standard of skill. It may reasonably be expected that the small-farm plan, if properly exploited, will result in the provision not only of convenient skilled labour, but also of economical labour, in that a system of mutually advantageous barter of labour, goods, and services will be found workable. For instance, labour charges might be met at times by the supplying of, say, a weaner pig or of breeding services, this resulting in an arrangement satisfactory to both parties. It is confidently believed that if the farming community consider the small-farm plan in its true position in our farming industry, it will be recognized not merely as a promising means of dealing with unemployment problems, but as a fundamentally sound means of remedying a long-felt serious weakness in the farm-labour position.

Important measures that often will need attention in the near future and that on many farms not only would lead eventually to increases in the amount of labour utilized, but also would result quickly in profitable returns, are top-dressing, drainage, formation of ensilage pits and trenches, preparatory cultivation for special cropping in excess of the amount previously carried out, as a means to improved feeding and possibly increased numbers of stock.

Pre-winter Top-dressing.

In view of the fact that recent deliveries of fertilizers have been exceptionally heavy, it would seem that generally farmers now more fully realize that good results are widely obtainable from pre-winter top-dressing. Any top-dressing that still remains to be done before the spring should be done as soon as possible; the special benefit of pre-winter top-dressing is to some extent lost if it is done when the soil is so cold that pastures have practically ceased growth until the arrival of spring conditions. The date of commencement of the period when it is too cold to top-dress grassland effectively varies according to the geographical position, so it is impossible to give guidance generally applicable, but it is certain that as a rule no avoidable delay should now be allowed to occur.

Although top-dressing should be carried out before the advent of the most inactive period of pasture growth, if this is at all possible, it may be advisable at times to top-dress during the "dead" period of pastures as an alternative to the inconvenience and, possibly, inefficiency, resulting from an unduly heavy rush of work in the spring. Phosphatic manures applied in the dormant period will exert their influence as soon as the warmth necessary for growth returns, and lost, as distinct from delayed, effect need not be considered. The same position is held to apply in general to lime and potash. But it is radically different with soluble nitrogenous manures;

if conditions unfavourable for growth prevail for any considerable time after the application of such manures their influence, judging from fairly extensive past experience, is considerably lessened.

As the top-dressing suitable for a wide range of conditions was discussed in considerable detail in the March, 1932, *Journal* the main matter that now needs repetition is the proved dominance generally of phosphates in profitable top-dressing. Almost invariably phosphates should be the foundation of top-dressing in New Zealand. Sometimes the best possible returns are not secured from phosphates unless materials containing one or more of the substances lime, potash, and nitrogen are also used. But on the whole, unless there is local evidence justifying the use of such supplements, their use is not considered judicious except in a trial manner.

Drainage.

There are thousands of acres of poorly-drained land in New Zealand which would quickly give profitable returns from money spent on drainage. Often drainage of isolated relatively small wet areas is a most profitable improvement which has the decided advantage of not necessitating heavy expenditure. Particularly when tile drains are being used, the drainage of isolated wet spots should be planned so as to locate the drain-lines in such a way that they would serve as part, and possibly as the basis, of any more comprehensive future work. In the present difficult times a point of some moment is that the first few pounds spent in drainage generally return the greatest percentage of profit—primarily because they remedy the most acutely adverse conditions.

One of the most important matters that should be kept in mind by those contemplating drainage is that money may easily be wasted—even in the case of land very poorly drained—unless the work is properly planned and carefully carried out. Considerable information about practical aspects of drainage was given in these notes in May and June, 1931, and advice is also obtainable from district officers of the Fields Division.

Seasonal Ensilage Work.

The provision of suitable ensilage pits and trenches, and the construction of home-made inexpensive ensilage equipment, offers scope on many farms for profitable utilization of labour during the relatively slack winter period. Pits and trenches are economical because they minimize wastage of crop material in comparison with the stack system of ensilage. On many farms the terraced or rolling type of land which favours the formation of suitable pits is not to be found, but the farms on which there are not suitable sites for trenches are not at all so numerous. This is indicated by the fact that in numerous instances really efficient results have been obtained by the use in almost perfectly flat paddocks of trenches approximately 4 ft. in depth. If a farm confines itself to the use of only one pit or trench, then almost necessarily there will arise the need either to cart heavy green material considerable distances, or to save silage from specific fields at such close intervals as will bring about unwelcome deterioration of their swards. As a means of avoiding the need of choosing between these undesirable alternatives, some progressive farmers provide themselves with a number of pits or trenches not all of which are filled each year. This excellent practice has the further advantage of bringing about the creation of reserves of feed—the advisability of which is well exemplified by the current feed position.

Cropping Work.

The matters relative to crop production and utilization which were discussed in last month's notes generally will also require attention in late May and June. Frequently the pulling and storing of mangels may suitably be done at this season, and this particularly applies to cases in which

the ground occupied by the mangels either will be used without delay for another crop, such as oats, or is apt to become very wet during rainy periods which may be expected soon.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Autumn Spraying of Stone Fruits.

WHERE an autumn fungicide has not yet been applied to stone fruits growers would be well advised to act in accordance with the information given in last month's notes. Where fungus diseases alone are to be dealt with bordeaux mixture will be found effective, but where insect pests are also to be contended with lime-sulphur should be substituted.

The Orchardist's Nursery.

Stocks for such fruits as pears and cherries, which may require to be purchased, should be ordered at once, and the collection of apricot, peach, nectarine, and plum stones should not now be delayed. In some parts of the Dominion it may not yet be too late to set out cherry-plum cuttings.

Planting.

Where planting is intended, whether for adding to the orchard, for filling gaps, or for replacements, the ground should be prepared well ahead of time. If the soil is in good tilth, and there is sufficient moisture without it being too wet, planting may be undertaken now in the warmer parts of the country. On the other hand, should the soil not have been properly prepared, or if it has become too wet and soggy, planting is better delayed until proper preparations are made and the soil has that degree of moisture and warmth necessary for the rapid start of the roots. When the trees arrive from the nursery they should be carefully and firmly heeled in until planting-time. Make a good trench, open up the bundles, and place the trees singly in the trench with a slope, work the soil well in among the roots so that there are no air pockets, and tramp well down. This care is necessary, as quite a number of losses have occurred through the young trees drying out before being planted, or from frost getting in among the roots.

Cultivation, Drainage, and Manuring.

In many orchards ploughing will now be one of the most important occupations, while in others this operation will be left over until the spring. The state of the soil and general management and environment of the orchard must decide the question of autumn versus spring ploughing. Where land is liable to become wet and soggy or to scour it may be wise to allow a cover-crop, even of weeds, to remain in the ground until the spring. The plough can, however, assist materially in some places by running the furrows in such a way that the surface water will drain away. Much controversy is at present taking place regarding the elimination of the plough in the orchard. Until a longer and wider experience has been gained with other implements which are being used in place of the plough it would be unwise to recommend the disuse of an implement so long and widely used.

Considerable assistance can be given to trees in many orchards or portions of orchards by a system of drainage of surplus water with tiles, stones, or even manuka, and now is the best time to undertake this class of work. In irrigated districts the levelling of the ground here and there to allow of better circulation of water, the cleaning and repairing of old races, and the making of new ones, should not be delayed too long.

Slow-acting manures, also super and sulphate of potash, may now be applied. It is good practice to plough these under in the autumn or winter, leaving the application of the quicker-acting nitrogenous manures until the spring. It is quite impossible here to recommend a general formula for manuring, as each locality (sometimes even each part of an orchard) may require different treatment. Advice should be sought from the local Orchard Instructor regarding specific treatment. Lime is generally applied from now on at the rate of 1 to 2 tons of carbonate of lime to the acre every three to five years. It should be sown on the surface of the ground and not ploughed under. A few general remarks on the manuring of fruit-trees will be given in next month's notes.

Pruning.

Pruning is still the most debated operation of the orchard. In this country it is still in a state of evolution, and has been so, to my knowledge, for the last twenty-seven years. Systems and styles are innumerable, and no set standard for a particular type of tree has yet been evolved. At the one end we have the system whereby no shoot is shortened but all cuts are made just above a lateral. At the other end is the system in which there is extensive removal of growths (especially strong ones), moderate laterals are shortened, and only very short shoots are left uncut. Between these two are many systems, modifications of one or other or both. And yet, under the guidance of experienced growers and pruners, wonderful crops of first-class fruit, with healthy vigorous trees, are being annually produced under nearly all these systems. All intelligent growers will co-ordinate their pruning with their general treatment of the trees, at the same time always having certain definite aims in view—namely, the production of a healthy vigorous tree of payable size, annually making adequate growth for current and future needs that will bear large annual crops of the highest quality and of a size suited to the market for which they are catering.

Under normal conditions these objects are best attained by moderate pruning, well balanced fertilizing and green manuring, efficient working of the soil, as far as possible the retention of an even moisture content in the soil, and adequate thinning of the crop and control of disease. The removal of worn-out timber, the shortening of moderate laterals, the shortening or removal of over-strong growths, and thinning-out to let in sunlight and air, form the most desirable type of pruning which will encourage reasonable growths and strong foliage. Where a gap has occurred in a tree, this should when opportunity offers be filled by a new leader or sub-leader. Often this may be achieved when a shoot comes up in a suitable position by leaving it unpruned for several seasons until it catches up to the surrounding leaders.

—W. R. Lloyd Williams, Orchard Instructor, Alexandra.

Citrus Culture.

The time is now approaching when the harvesting of citrus fruits will be receiving consideration. The chief object of any fruitgrower should be to try and create a good impression as he markets the first fruit of the season.

It is possible to commence gathering Poorman oranges before they are fully matured, or when only partly ripened, and then complete the process by artificial means. This is not good practice, and should not be carried out. The longer they are allowed to remain upon the tree within reason, the more palatable they become as a breakfast fruit. It is in this direction more particularly that growers should look for an increased market for Poorman oranges. Sweet oranges should be left to reach maturity on the

tree, otherwise the flavour will not be sufficiently good to command attention. On the other hand, overmaturity and dryness should be avoided, but this condition is not usual until well on in the season or when the trees have been frosted.

Lemons should be cut when they have reached the size that is mostly demanded. The colour is not of so much importance as the size. The fruit when cut can be stored and cured before it is ready for marketing.

During the next few months growers will no doubt be anticipating occasional frosts. This subject was dealt with in the citrus notes in the *Journal* for May, 1931, and I would strongly advise growers who may be subject to such visitations to try and safeguard their crops by putting into operation the measures there indicated.

—*L. Paynter, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

Management of the Breeding Hens.

Now that the hens previously selected as prospective breeding specimens will have in most cases completed the moulting process, it is important that they be specially fed and managed in order to ensure their being in the best possible breeding condition when the mating season arrives.

As the birds are not producing there will be a tendency for them to become overfat, a condition which should be avoided at all costs from now on to the termination of the breeding season. There is ample proof that the hen carrying surplus fat does not produce desirable progeny. While it is true that the high-type layer when in a laying condition cannot be overfed on proper egg-producing food, it is possible to make even a good laying bird overfat when she is on a diet such as is desirable for breeding birds, when there should be little forcing ingredient, such as meat or its substitutes, included in the ration. It will generally be found that better incubating results will be obtained and stronger chicks produced from the feeding of a variety of whole grains, such as wheat, oats, maize, and barley, for both morning and evening meals.

Then, if the birds are to be maintained in their best vigour and the formation of body fat prevented, they must be compelled to exercise as much as possible. The best means is to make them scratch for the grain ration in deep litter. In addition, and where possible, a free range should be given, or at least a good-sized yard, affording some semblance to the condition their nature demands. In a general way, the coddled bird is far from the ideal specimen to breed from for the maintenance of a heavy-producing flock.

No attempt should be made to force the birds to a laying point in the shortest time possible, or to secure a high egg-yield by including in the ration a large proportion of forcing food such as meat, as this will generally result in weak fertility, poor hatches, and the production of chicks that are difficult to rear. Obviously, a bird that has been forced to the limit for egg production right into the late autumn, and has later to undergo the heavy strain entailed on the system by moulting and renewing its feathers, will not be in a fit condition at the commencement of the breeding period to produce eggs with the strongest germs unless given every opportunity to recuperate. The provision of ample green material should not be forgotten, as it is one of the chief foodstuffs for promoting good health, while a liberal supply of fresh water, gravel grit, and broken sea-shell should be in reach of the birds at all times. Above all, the quarters should be kept in a thoroughly clean state, which is the main essential in preventing disease and insect pests from making their appearance.

The Breeding Cockerels.

The foregoing advice applies in even greater force to the cockerels that have been selected for future breeding purposes. A mistake made on many plants is to give the cockerels specially selected for next season's breeding-pen treatment similar in all respects to that given the birds intended for market. The cockerel intended for table purposes should be rapidly developed, and to this end should have restricted range and a rich diet, whereas the prospective breeding male should have good range and an ample but simple ration. In other words, the market cockerel demands artificial conditions and the breeding cockerel as natural a scheme of treatment as possible. More harm is done to the future breeding cockerel by coddling from the brooder onwards than by anything else. This does not imply any stinting of food, but rather management tending to promote stamina, and nothing in this connection can take the place of full opportunity for free range under natural conditions. It is easy to understand that the overfeeding of rich foods, such as meat, to birds during the developing stage and when confined in small runs or coops, is almost sure to encourage size of body rather than sound development of the limbs required to carry it. It should never be forgotten that the male bird is more than half the breeding-pen. Not only should he possess the qualities of undoubted stamina and utility, but he should have every opportunity of maintaining himself in the best possible form.

Feeding of Iodine to Fowls.

For some considerable time past the writer has frequently been asked for advice in regard to the feeding of iodine to fowls, and in order to discover as far as possible its value for this purpose comprehensive trials were recently carried out at the Wallaceville Poultry Station. The results of these experiments indicated in a striking manner that the feeding of iodine to fowls provided with a plain ration which is available to the average poultry-keeper did not have any beneficial influence on (1) egg production, (2) weight of eggs, (3) hatchability of eggs, (4) quality of chickens, (5) colour of yolk. In other words, the difference in egg-yield, the size of the eggs, their fertility and hatchability, &c., between eggs produced from the birds fed with and those from fowls without iodine was only what would be expected under ordinary conditions.

The twenty-four pullets which took part in the test were of the same age and of similar type in all respects. These were placed in single pens for several months previous to the commencement of the test. It was considered that by using females confined in single pens, both for the feeding test and as controls, their individuality could be better studied and observed than by running the birds in flocks. The male birds which took part in the test were changed to a different pen each hour daily from 9 a.m. to 5 p.m., while each male was placed in a single pen by himself during the night, and some were provided with iodized food while others were not.

The morning mash was made up of 1 part whole wheat-meal by measure, 1½ parts bran, ½ part pollard, with 10 per cent. by weight of meat-meal added. The evening meal consisted of three parts of wheat to one part of whole small-sized maize. Green food—silver-beet and finely chaffed green oats—was fed daily, while broken oyster-shell, gravel grit, and clean water were in reach of the birds at all times. A potassium iodide solution made up with 11–52 grammes K.I. in 3,000 c.c. was added to the water with which the morning mash was moistened for the test birds. One fluid ounce of this solution was included in the mash for every twelve birds each day. The control birds were given a similar ration in all respects, excepting that no iodine was included in it.

Towards the termination of the feeding test, which lasted for a period of five weeks, the birds showed a decided dislike for the food in which iodine was included. In fact, the greater number of the birds absolutely refused to eat the food, prefering to wait until the following feeding-time in order to secure a meal in which iodine was not included. The fact that the birds showed a dislike for the iodized food indicates that the amount of iodine secured in a natural way from the ration provided was sufficient for their bodily requirements, and that the amount artifically supplied increased the quantity beyond what was demanded by nature. This was borne out to some extent by the fact that birds which refused to eat the morning mash containing iodine ate greedily, if given the opportunity to do so, the mash in which iodine was not included.

It may be mentioned that the pollard fed during the test came from Australia, the maize from South Africa, the wheat and bran from Canterbury, the meat-meal was produced in the North Island, the green food was grown at Wallaceville, while the oyster-shell consumed came from the bottom of the sea at the Bluff. In view of the different localities in which the ingredients of the ration were produced, it would no doubt have been a remarkable coincidence had the food and oyster-shell provided not contained the amount of iodine necessary to satisfy the birds according to the dictates of instinct.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Preparations for Winter.

As the off-season is approached, and before the weather breaks for winter, it is essential to make the hives as snug as possible. New Zealand has its season which corresponds with the winter months in colder climates, when breeding almost ceases and food is scarce or entirely absent in the fields. Every effort should therefore be made to conserve the natural warmth of the bees. As indicated last month, mats are essential, and each hive should have at least two, and two spare ones, as occasionally dry mats are needed in exchange for damp ones. Good clean corn-sacks make the best mats. Cut the mats so that they exactly cover the frames, and on no account allow them to extend beyond the walls of the hive, or they will become wet and cause dampness, thus endangering the health of the bees.

Removal of Spare Supers.

All supers not occupied by the bees should be removed preparatory to making the hives as snug as possible. A strong colony with a good queen at this time will need its brood-chamber and at least a super, and these will be fairly crowded with bees, most of them bred since the close of the working season. These are the colonies which one should strive to have at this season of the year, as they will come out strong in the spring and give the best returns when the main honey-flow sets in. As robber bees are likely to become troublesome when removing the supers, the best and safest plan is to use bee-escapes, for it will be found that quite a lot of bees must be got rid of before the supers can be removed. By placing the escapes on the hives in the evening the supers will be clear of bees in the morning, providing that is no brood in the combs. If escapes are not used all hive-manipulations should be carried out expeditiously and as early in the day as is convenient.

Spare Combs.

In the absence of a proper comb-room, or any convenient place for storing the combs to keep them clean from the wax-moth and vermin,

they, with the supers, may be placed on the hives after confining the bees below with close-fitting mats. As a temporary means of protecting combs this plan serves the purpose. However, it is not a good one for preserving the combs for any length of time during the winter months, as there is a danger of the combs becoming mouldy. This will occur sooner or later in supers from which the bees are entirely shut out.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

At the request of a grower, who stated that his crop of vegetable marrows was attacked by disease, an inspection was made during the early autumn. The crop was found to cover about half an acre, was fully grown, and well set with "fruit." It had evidently been a most promising crop, but when visited three parts were completely enveloped in powdery mildew fungus and a small portion had quite withered up. No marrows had been grown on the farm for three years, and on the area in question no marrows had been grown for five years. A sample was taken for examination, and the subsequent report stated: "These leaves are infected with powdery mildew due to the fungus *Erysiphe cichoracearum*. This attacks a great number of plants, and could readily spread from these to marrows. It may be combated readily by one or more applications of colloidal sulphur (2–100)." Fungi of this genus are commonly found attacking herbaceous plants in the garden; delphiniums are very subject to the trouble, and it is useful to know that a liquid sulphur spray will prevent its spread. If a strange disease makes its appearance in a crop, growers should send in a sample at once to the the Director, Horticulture Division, Department of Agriculture, Wellington, and see if anything can be done about it. Prompt attention in the foregoing instance would have saved a valuable crop.

Potatoes, onions, and other produce in storage should be carefully examined at regular intervals, and they should be given the necessary attention. Conditions may easily become too dry for the satisfactory storage of potatoes or too moist for onions; ventilation also must be attended to. With these attentions there is little trouble in keeping these products in good condition throughout the winter if they are firm, sound, and clean to begin with. More often they are of a mixed class and require a lot of handling to sort out waste. This work, waste, and contamination of the premises could be avoided if the crop were graded for soundness at the first handling.

In preparation for the spring-time planting and sowing, ploughing and cultivation should be completed now as soon as weather permits the soil to be sufficiently dry for working. It then has time to consolidate, organic material to decay, and weed seeds to sprout and be destroyed. It is a great advantage for this to take place before planting or sowing the crop, more especially during the spring-time. A generous dressing of organic manure turned under now is generally desirable, even if it is only bonedust. On light land one can hardly be too generous; on heavy land that is well-drained a good dressing may be given, but if such land is moist and the drainage rather inefficient, an excessive application of humus may do serious harm. The mistake, however, is rarely made except on small areas.

For permanent crops such as asparagus and rhubarb, which are planted about the month of August, a rich deep, clean tilth is particularly

necessary. But for root crops and tomatoes, dressings of farm manure turned in before sowing produce coarse roots and plants that are undesirable. For these the humus must be perfectly assimilated by applying it before a previous crop. Most other crops require good treatment in this respect, and for celery it is essential.

Crops of spring cabbage and cauliflower will now be established, and light cultivation during dry intervals will be necessary to suppress weeds. Any gaps made by plants failing should be filled.

Pruning of Bush Fruits.

In the successful cropping of bush fruits good pruning at the proper season is perhaps the most important factor. Where suckers are allowed to grow up from the base of gooseberry plants, and rank growth fill the centre of the bushes, a quantity of small late fruit difficult to gather is the best one can expect. The result is very similar where other kinds are neglected. Heavy crops of good quality can only be grown where the growth is intelligently regulated. Much of this is best done in the summer so soon as the crop is gathered; the energies of the plant are then directed into the proper channels instead of being wasted. However, pruning treatment should be considered now, and where it has been neglected in summer it will now be heavy; but if good crops are expected this operation when performed with patience and intelligence will do more than anything else to secure it. Apart from a few commercial growers it is rare to see these crops in good condition, which is unfortunate, as for preserves and summer use they are important.

In the case of gooseberries, remove now completely rank growth frequently found crowding the centre of the bushes, also suckers about the base. It is only making matters worse to cut them back; they must be removed completely. The work is then completed by cutting back wood that fruited last season to the bud at the base, treating last year's growth that is weak in a similar manner. It is the strong young last year's wood that is left which will carry the crop of the coming season, which will be of good size, abundant and easily gathered if other conditions are right.

In the case of black currants, which grow so well on good land in the cooler districts, the best fruit and most of it is produced on strong young wood made during the last season; even the suckers are fruitful. It follows then that the wood which fruited last year can be dispensed with; it should be cut back to just above the lowest bud. This plant does not demand the sunshine and light to the extent that others do, and an open centre is unnecessary. Where this pruning treatment has been neglected in the past, and the wood is of a nondescript type, these instructions are not easily applied, but the wood should be well thinned out, and the character of the plants will improve in a way that will soon make pruning easier in the future.

With raspberries and loganberries it is important that the fruit-bearing wood should be removed so soon as the crop is gathered, and all weak shoots from the ground suppressed. If that has not been done it should be done now, cutting the canes away at the surface of the ground.

When pruning is completed apply a spray of winter strength bordeaux and turn under a green crop, or a dressing of well-decayed farm manure or fowl manure in a friable state. It is important that this cultivation should be very shallow, or serious damage will be done to the fibrous roots.

Sowing for the Indoor Tomato Crop.

For the indoor crop of tomatoes the seeds should be sown now. It is of first importance that a suitable variety and strain should be chosen. It is very common to find crops deficient in this respect that no amount of after-attention will remedy.

The seeds are best raised in a heated glasshouse, but a hotbed is suitable if it is properly made. This bed is sometimes made up in a large house in which tomatoes are to be grown, although it is somewhat in the way of cultivation there. A hotbed should be made of fresh stable manure, but it is not uncommon to see them made up without any preparation. A steady heat over a long period cannot be obtained in that way. If it is turned over, shaken out, and firmly restacked two or three times at intervals of a few days, the improved results will be found well worth the trouble. When turning it all dry parts should be sprinkled with water. The final result is that bacterial action, causing fermentation, is active throughout the mass, and maximum results are obtained. Where stable manure is scarce, fallen leaves from deciduous trees are useful to supplement the supply.

Sow the seeds in boxes containing a good loam moderately rich, and with sufficient sand to keep it open; no chemical fertilizers are needed. A temperature of 55° to 65° F. is required for satisfactory germination. If the hotbed is outside see that good covers are ready to protect the frames in frosty weather. A humid atmosphere and high temperatures are the dangers that are most likely to do harm. Apply tepid water moderately during the morning, as required, but use it sparingly. Ventilate freely in fine weather, and close the frames in the afternoon before the outside temperature commences to fall. If these rules are maintained, sturdy plants are grown which will lose no time in doing what is expected of them.

The glasshouse in which they are to be planted should now be thoroughly clean, and a strong green crop growing with plenty of ventilation. This crop must very soon be turned in so that it may thoroughly decay before the time arrives for planting out. This decay is assisted by having the land thoroughly moist. It is quite usual to find the land in these houses far too dry at this season of the year; it should be thoroughly soaked so that little water need be applied for some time after the tomato plants are put out, and the danger of chilling them will be greatly lessened.

The Homestead Garden.

Hardy shrubs should now be pruned. Where growth is crowded it should be thinned out by complete removal of unnecessary wood—that is, it should be cut away close up to the point of issue; by admitting an abundance of light and air the branches are kept furnished with foliage and flowers. Where more growth is needed it may be obtained by cutting away now from young growth one-half to two-thirds its length. This has a most invigorating effect on the part so treated. Climbers especially should be kept well in hand by proper pruning in winter and summer as may be necessary. The luxury of seeing well-trained wistarias, begonias, &c., in flower might easily be much more common under the great advantages of climate which we enjoy. Shrubs flower usually on (1) short thick growths that are called spurs; (2) young wood of last year's growth; or (3) new wood. In each case the fact should be ascertained, and it is the main one to be borne in mind when pruning.

Established shrubberies would be greatly benefited now by a generous mulch of decayed farm manure. It can be lightly forked in, but deep digging should be avoided. The front of these borders is very commonly used for herbaceous planting, but this is not generally a suitable arrangement. Most of the popular plants of that kind require rich ground that is well trenched every three or four years, and so their interests clash very seriously with that of the shrubs. The foreground is better planted with some of the dwarfer shrubs such as the veronicas, hydrangeas, fuchsias, &c., or, if herbaceous planting must be done, the choice should be limited to those kinds which enjoy the environment the shrubs afford.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: APRIL, 1932.

Dominion Meteorological Office.

THE principal characteristics of the weather in April were mild and humid conditions and an absence of wind.

Rainfall.—Rain was below normal in parts of the Bay of Plenty area, in all of Wellington except the eastern coastal portion, and in much of Nelson and the West Coast of the South Island. Elsewhere there was an excess, which in many cases was considerable. Even when there was no rain, much of the weather was damp and, in the North Island especially, showers were frequent.

Temperature.—After a prolonged period with temperatures in nearly every month below normal, it is pleasing to record that April was almost everywhere somewhat warmer than the average. This was most noticeable in the interior of the North Island. A few frosts were recorded, but they were not severe, and vegetation was practically undamaged. The high ranges received a few light falls of snow.

Wind.—The absence of wind was one of the most pleasing features of the weather. There were very few strong northerly winds, and southerlies generally prevailed. A strong north-easterly gale blew in the North on the 27th and 28th.

Sunshine.—There was more cloud than usual, and sunshine was in consequence considerably below the average. There were, however, some very fine days.

Pressure Systems.—Intense anticyclones were a feature of the weather charts, the pressure exceeding 30·4 in. on several occasions.

Rain was widespread on the 4th and 5th, with heavy falls in the North, when a rather irregular westerly depression crossed the Dominion.

The next rainy period culminated on the 10th, when a shallow cyclone crossed the South Island. Rain was practically general, with many heavy falls. On this occasion there were some very heavy rains in Canterbury and Otago.

A series of westerly depressions passing between the 20th and 23rd brought rains to districts with a westerly aspect.

The most notable storm of the month, however, was one which began as a severe tropical cyclone in the New Hebrides on the 25th. This cyclone moved in a south-south-easterly direction, and on the 28th had reached the neighbourhood of Cape Maria van Diemen. Thence it passed slowly down the east coast. Heavy rain began in the far North on the 27th and extended southwards, conditions being still unsettled at the end of the month. In North Auckland the falls were very heavy on the 27th and there was some flooding. On the 28th and 29th the area of heaviest rain had moved to Hawke's Bay, and most of the rivers in that Province were in high flood. At Anawai, near Havelock North, 9·47 in. was recorded on the 29th, and many places had over 4 in. in twenty-four hours. Considerable damage was done by the floods, but ample warning had been given, and at a critical stage the rain moderated. Marlborough and North Canterbury also experienced heavy rains during this period, and few places escaped altogether.

Feeding Sheep on Potatoes.—In the Willowbridge district of Canterbury last winter, owing to unpayable market prices for potatoes, the tubers were extensively used for feeding sheep. In some cases they were merely ploughed up and the sheep turned in on them.

RAINFALL FOR APRIL, 1932, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	6·03	9	2·72	4·31
2	Russell	5·75	9	2·15	4·14
3	Whangarei	3·41	14	2·22	5·00
4	Auckland	4·05	17	1·21	3·54
5	Hamilton	4·24	16	1·50	3·84
6	Rotorua	4·08	16	1·01	4·52
7	Kawhia	4·89	17	1·70	4·65
8	New Plymouth	7·40	17	1·83	4·54
9	Riversdale, Inglewood ..	9·24	16	1·72	8·08
10	Whangamomona	7·71	11	1·80	6·47
11	Eltham	5·28	16	0·92	5·21
12	Tairua	6·31	14	1·35	5·94
13	Tauranga	7·88	16	2·26	4·68
14	Maraehako Station, Opotiki	3·15	17	0·56	4·83
15	Gisborne	5·07	13	3·10	4·04
16	Taupo	4·20	17	1·21	3·57
17	Napier	2·94	12	1·15	2·78
18	Hastings	3·63	10	1·43	3·32
19	Taihape	2·71	17	0·69	2·79
20	Masterton	1·62	10	0·44	3·08
21	Patea	3·46	11	1·04	3·67
22	Wanganui	2·70	12	0·99	3·28
23	Foxton	2·00	10	0·62	2·53
24	Wellington	2·69	15	0·62	3·53
	South Island.				
25	Westport	7·94	15	1·45	8·35
26	Greymouth	8·33	14	2·45	8·46
27	Hokitika	11·67	16	2·30	9·29
28	Ross	15·54	11	4·40	12·03
29	Arthur's Pass	12·78	10	3·53	15·59
30	Okuru	12·15	11	2·00	14·14
31	Collingwood	8·34	16	1·31	8·13
32	Nelson	1·89	12	0·37	2·99
33	Spring Creek	2·83	11	1·10	2·09
34	Hanmer Springs	3·73	11	1·17	3·30
35	Highfield, Waiau	3·45	8	1·30	2·71
36	Gore Bay	3·22	7	1·30	2·33
37	Christchurch	1·52	11	0·73	1·85
38	Timaru	4·26	9	2·00	1·52
39	Lambrook Station, Fairlie ..	3·30	9	1·71	1·94
40	Benmore Station, Clearburn	2·78	12	0·93	2·39
41	Oamaru	3·57	8	1·91	1·76
42	Queenstown	2·98	11	1·04	2·98
43	Clyde	2·55	8	1·47	1·42
44	Dunedin	4·63	13	2·35	2·74
45	Wendon	3·25	10	1·20	2·67
46	Gore	..	..	..	3·12
47	Invercargill	4·16	16	1·00	4·14
48	Puysegur Point	6·19	15	1·60	7·75
49	Half-moon Bay	4·12	14	0·77	5·16

Control of Wing Thistle by Sodium Chlorate.—Trials in Hawke's Bay indicate that a 2½ to 5 per cent. solution of sodium chlorate will kill out wing thistle.

THE LATE STENHOUSE WILLIAMS: AN APPRECIATION.

THE death occurred on 2nd February last of Dr. R. Stenhouse Williams, Director of the National Institute for Research in Dairying, Shinfield, and Research Professor in Dairy Bacteriology at the University of Reading, England.

When the National Institute was first established in 1912, and provided with humble quarters in the attic of a private dwelling, it was Dr. Williams's success in public-health bacteriology that led to his appointment. During all his dairy work he always maintained the viewpoint that the health of the nation could be immensely improved by encouraging the consumption of more and more milk which had been obtained under clean and sanitary conditions from healthy cattle. Apart from the fact that the sale of more milk would benefit the farmers who thereby earned their living, he maintained that the elimination of diseased cattle from the herds would at the same time avoid losses of a magnitude quite unrealized by the farming community. Progress towards his ideal was at first slow, but his appreciation of the difficulties besetting the dairy-farmers enabled him to enlist their co-operation in increasing numbers. He lived to see carried out immense improvements both in the handling of milk and in the health of dairy cattle in England.

Figures compiled some years ago showed that in England the value of the fluid milk trade amounted to about £50,000,000 annually, in addition to some £10,000,000 worth of milk manufactured into butter and cheese. In spite of the effort required to study the problems of an industry of this magnitude Dr. Williams found time to devote to the dairy problems of distant parts of the Empire, where information about the latest discoveries is frequently difficult to obtain. To assist in the local application of knowledge already available and to avoid wasteful duplication of expensive researches, the Empire Marketing Board a few years ago provided funds to establish under his able editorship the *Journal of Dairy Research*—the first journal in the Empire devoted solely to the scientific side of the dairy industry. As a pioneer in the clean-milk movement he achieved a world-wide reputation, and his unique experience and comprehensive knowledge gave special importance to his writings.

Dr. Williams was a man of untiring energy, who never spared himself in the discharge of the duties which devolved upon him, nor could he be persuaded from the narrow path which he believed to be his duty. Short cuts of any description were anathema to him, for he took a pride in doing things thoroughly and inspired others to do likewise.

He leaves two great memorials—a great Imperial industry guided to higher standards, and a valuable National Institute for Research in Dairying which grew to its present position under the wonderful spirit of loyalty which he inspired in a band of enthusiastic co-workers.

—G. M. Moir, Wallaceville Laboratory, Wellington.

PRICE OF STRYCHNINE FOR RABBIT POISONING.

OWING to the increased cost of supplies the Department of Agriculture has found it necessary to increase the price of alkaloid powdered strychnine from 3s. 3d. per ounce to 4s. per ounce. Case lots containing 100 oz. are obtainable at 3s. 6d. per ounce.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FEEDING SILAGE TO BREEDING-EWES.

H. K. RENDELL, Kiwitahi :—

In feeding silage to breeding-ewes what weight per day should be given to sheep started in a good store condition? Would it be better to finish feeding just before lambing starts, or to commence feeding later and feed until lambing was well through—say, towards end of August—and working the ewes out as they lamb?

The Live-stock Division :—

The amount of silage to be fed depends on the condition of the pasture. If this is very bare you could feed up to 5 lb. per day, but if there is a fair amount of feed then 2 lb. to 3 lb. per day would do. In this *Journal* for October, 1930, was published the opinion and experience gained by a number of farmers who had tried out feeding silage to ewes. Sheep do not care for the stemmy silage of poor quality, but cattle will eat this with impunity. By making silage for sheep one is able to keep the pasture in a much better condition for sheep-feeding. The best time to cut is just when the grass is getting into bloom, and the aftermath then comes away rapidly. With regard to the feeding of silage, you would probably not lose anything by feeding right through into September. Practical farmers have fed silage with most satisfactory results for several years.

MANURING FOR POTATO CROP.

"INQUIRER," Marton :—

Would the contents of a three-year-old haystack, rotted through rain, be of any value as regards manure for a potato crop? I intended spreading the contents of the stack on to a grass field, and ploughing deeply in June for planting in late August. The soil is of a light nature and suitable for potato-growing. Would sheep manure from a wool-shed night-pen, and applied in the same manner as the hay, be more suitable for potatoes?

The Fields Division :—

Well-rotted hay is valuable as a partial manuring of potatoes, and specially when incorporated with light soils of low humus content, inasmuch that nitrification is assisted, and the ammonifying power of the soil increased. It must not be regarded as a complete manure, the inclusion of a phosphatic fertilizer being essential to the growth of potatoes. The action of sheep-manure from a wool-shed night-pen produces a similar effect, but, owing to its high nitrogen content, should be used sparingly when manuring for potatoes. A heavy application of sheep-manure will bring about excessively rapid growth, which is detrimental to the potato, and the resultant crop is liable to contain a large number of hollow-heart tubers.

REMOVAL OF FRUIT-TREES.

"ORCHARD," Waitomo Caves :—

I desire to remove trees, some having been planted out for four years, others three years. They are mainly apple, pear, peach, cherry, nectarine, plum, lemon, and orange. Would you please advise me the most desirable time to remove same, also the surest method to adopt?

The Horticulture Division :—

The citrus and deciduous fruit-trees mentioned may be removed while in a dormant state. The work should be done when the soil is dry, and holes prepared so that replanting may be done as soon as possible, so avoiding exposure of the roots

to drying winds. Lift the trees carefully with a large ball of soil, and wrap them securely with hessian to avoid damage in transit. Large trees are generally best carried on a sledge. Prune the trees rather severely and paint the larger wounds that may be made. Leave the citrus-trees until the last; early in September will be soon enough for their removal. Should dry weather follow, mulch the surface of the ground over the roots.

LIME FOR POULTRY AND CATTLE.

"AMATEUR," Pukekohe :—

Would you kindly advise me if it is good policy to put lime in the fowls' drinking water all the year round, and, if so, how much should be used per gallon, and what kind of lime? Would burnt shell lime do? Would putting lime in the water also be good for cattle?

The Live-stock Division :—

Fowls need lime for bodily requirements and for the making of egg-shells, but no one can gauge an individual bird's requirements for these purposes. By adding lime to the drinking water throughout the year a bird might easily be compelled to consume more lime than is good for it. The best means of providing the lime is to have ample broken oyster or other sea-shell available where the birds can pick at it as they choose, and thus secure the quantity necessary to satisfy the demand of nature. Where lime is required by cattle it can be given in the form of slaked lime put in the drinking troughs, or by feeding a mixture of bonemeal and coarse salt in equal parts. This lick should be put in boxes and placed where the stock have daily access to it.

STINKING CAMOMILE IN PASTURE.

"INQUIRER," Whakapara :—

I have a paddock carrying good grass and clover which I do not wish to plough, and which has in places what they call "stinking caramel." Is this plant harmful to stock, and, if so, what is the best means of getting rid of same?

The Fields Division :—

The plant in your pastures is probably *Anthemis cotula*, known as stinking camomile or stinking mayweed, an erect branched annual of the daisy family, distinguished from several other similar weeds by the strong, disagreeable smell produced when the flower heads are bruised. Stock will not eat it on account of the unpleasant taste. Since it is an annual, re-establishment each year in a pasture is entirely dependent on reseeding. It is best eradicated, therefore, by hand pulling and burning if scattered, or by mowing to prevent flowering if plentiful.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 24th March to 5th May, 1932, include the following of agricultural interest :—

No. 66414 : Harrow; C. F. Bennett. No. 67292 : Milking machinery; D. MacMillan. No. 65906 : Weed-killing device; C. F. Turner. No. 66006 : Milk-can trolly; C. Swanson. No. 66079 : Sprayer; C. M. Brown. No. 66408 : Foot-piece for wooden posts. No. 66940 : Cultivator; W. A. Abbott, L. D. Abbott, and T. Thomassen. No. 66941 : Plough; W. A. Abbott, L. D. Abbott, and T. Thomassen. No. 67185 : Apparatus for castrating animals; Daroux Emasculators, Ltd. No. 68020 : Fungicide; Grasselli Chemical Co. No. 66617 : Treatment of flax; W. E. Langguth. No. 66688 : Silo; W. C. England. No. 66727 : Tool for extracting honey; J. C. Clark. No. 67001 : Grading of fruit; E. H. T. Bensemann. No. 67862 : Milking-machine; L. F. Ellery. No. 67687 : Lamb marking and operating cradle; J. Y. Shannon. No. 68574 : Tine harrow; E. C. Bellve.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.